

24

DHS COMPARATIVE STUDIES

Maternal Nutritional Status



**DEMOGRAPHIC
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SURVEYS**

The Demographic and Health Surveys (DHS) is a 13-year project to assist government and private agencies in developing countries to conduct national sample surveys on population and maternal and child health. Funded primarily by the U.S. Agency for International Development (USAID), DHS is administered by Macro International Inc. in Calverton, Maryland.

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Maternal Nutritional Status

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Preface

One of the most significant contributions of the DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Comparative Studies* series and the *DHS Analytical Reports* series examine these data across countries in a comparative framework, focusing on specific topics.

The objectives of DHS comparative research are: to describe similarities and differences between countries and regions, to highlight subgroups with specific needs, to provide information for policy formulation at the international level, and to examine individual country results in an international context. While *Comparative Studies* are primarily descriptive, *Analytical Reports* utilizes a more analytical approach.

The comparative analysis of DHS data is carried out primarily by staff at the DHS headquarters in Calverton, Maryland. The topics covered are selected by staff in conjunction with the DHS Scientific Advisory Committee and USAID.

The *Comparative Studies* are based on a variable number of data sets reflecting the number of countries for which data were available at the time the report was prepared. Each report provides detailed tables and graphs for countries in four regions: sub-Saharan Africa, the Near East and North Africa, Asia, and Latin America and the Caribbean. Survey-related issues such as questionnaire comparability, survey procedures, data quality, and methodological approaches are addressed in each report, as necessary. Where appropriate, data from previous DHS surveys are used to evaluate trends over time.

Comparative Studies published under the current phase of the DHS program (DHS-III) are, in some cases, updates and expansions of reports published earlier in the series. Other reports, however, will cover new topics that reflect the expanded substantive scope of the DHS program.

It is anticipated that the availability of comparable information for a large number of developing countries will have long-term usefulness for analysts and policymakers in the fields of international population and health.

Martin Vaessen
Project Director

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Executive Summary

Nutritional status based on the measurement of maternal height and weight is one of the important outcome measures of the Demographic and Health Surveys (DHS) program. Since nationally representative samples are used, DHS data permit a comparison of maternal nutritional status within and across countries. This report presents information on the nutritional status of women who have children born in the five years preceding the survey. It also analyzes the differentials in nutritional status levels by selected demographic, socioeconomic, and health-related characteristics. Two basic indicators of maternal malnutrition obtained from the *body mass index (BMI)*¹ distribution are used: *chronic energy deficiency*, the percentage of women with BMI < 18.5, and *obesity*, the percentage of women with BMI 30+. The relative risk of malnutrition is examined using multivariate analysis to determine the effects of a particular variable when other variables are held constant.

Level of malnutrition, that is, chronic energy deficiency (CED) or obesity, differs from region to region and from country to country, but three general patterns are identified:

- (1) The African pattern shows high levels of chronic energy deficiency and low levels of obesity. Women tend to be tall and thin, with 10 percent or more of the mothers classified as malnourished.
- (2) The Near East/North African pattern has low levels of chronic energy deficiency but high levels of obesity.
- (3) The Latin American pattern has relatively low levels of chronic energy deficiency and moderate levels of obesity.

Differentials

The nutritional status of mothers varies by age because of weight gain during the reproductive years, with younger mothers having greater prevalence of chronic energy deficiency. As with age, the BMI increases with mother's parity, except in some countries where parity 6 or higher is associated with lower BMIs and, therefore, higher percentages of chronic energy deficiency. Some of the increase observed in the mean BMI by parity is associated with obesity. Obesity increases with parity; however, for some countries it decreases after parity 4-5. The results suggest the existence of long-term maternal depletion, which tends to occur in countries with high levels of fertility. Almost all the DHS countries show a consistent pattern linking short birth intervals with malnutrition.

The postpartum period—during which breastfeeding can affect the weight of the mother—influences the level of chronic energy deficiency during the first year and a half after the birth of the child. Variations are observed by country, probably related to the length of the lactation period. In sub-Saharan Africa, where the average length of breastfeeding is around 20 months, the percentage of mothers with chronic energy deficiency increases with the duration of the postpartum period and stabilizes around 10 percent after three years. Women tend to lose weight over the course of lactation, thus affecting their BMI. Although mean BMI is lower for lactating mothers, in 7 of the 18 countries analyzed, chronic energy deficiency percentages are higher among nonlactating women. As expected, obesity is more prevalent among nonlactating women.

BMIs are lower among mothers of low birth weight children. The prevalence of chronic energy deficiency by birth weight of the last child is highest in sub-Saharan Africa. Likewise, mothers of stunted children in sub-Saharan Africa show greater prevalence of chronic energy deficiency, particularly mothers of younger children (< 24 months). The descriptive analysis of malnutrition and child survival produced mixed results with no specific pattern across countries or regions.

Levels of maternal malnutrition vary by background characteristics. Chronic energy deficiency is more common in rural areas in almost all DHS countries, while obesity is predominantly an urban manifestation. As expected, malnutrition decreases with mother's education, especially in sub-Saharan Africa. Compared with education, the socioeconomic status of women seems to be a better predictor of both chronic energy deficiency and obesity. The higher the socioeconomic status of the mother, the lower the prevalence of malnutrition, particularly in sub-Saharan countries. Ethnicity and religion also affect levels of maternal malnutrition. In Latin America, indigenous mothers tend to have higher levels of chronic energy deficiency and lower levels of obesity compared with women whose main language is Spanish. On the other hand, in Turkey, obesity is higher among ethnic Turkish mothers than non-Turkish mothers, and higher in Egypt among Muslim mothers than non-Muslim mothers.

Relative Risk

A multivariate analysis confirms most of the findings presented in the descriptive analysis, particularly in terms of the direction of the relationship between chronic energy deficiency and its covariates. At least one of the socioeconomic variables (place of residence, education, socioeconomic status, ethnic group) entered the model, not only confirming its importance in explaining maternal malnutrition, but also verifying a higher prevalence of chronic energy deficiency among the poor. As for

¹ Weight in kilograms divided by height squared in meters (kg/m²).

obesity, the following variables have significant effects over and above the other variables in the model: age, place of residence, socioeconomic status, and the parity of the mother. The relative risk of obesity for urban mothers is considerably lower than for their rural counterparts, which is the opposite of results presented in the descriptive analysis. In general, the higher the socioeconomic status or education of the mother, the higher the relative risk of obesity. These findings are substantiated by analysis of variables for ethnicity, religion, and language.

The results indicate that the risk of obesity is explained primarily by socioeconomic variables and seems to be a greater problem in North African and Near Eastern countries. At the same time, the risk of chronic energy deficiency is also explained largely by socioeconomic variables, especially in sub-Saharan Africa. Biodemographic variables appear to be operating as intermediate variables affecting maternal malnutrition.

Improvements in maternal nutritional status will only be seen when mothers and their children are no longer exposed to the risks factors leading to malnutrition. Some of the actions that would reduce these risks factors are described in the Program of Action of the 1994 International Conference on Population and Development.

1 Introduction

Governments and international organizations around the world are concerned about the health and nutritional status of women. The two most recent statements of this concern are embedded in the declarations and plans of action approved at the 1994 Cairo International Conference on Population and Development (United Nations, 1994) and the 1995 Beijing World Conference on Women. Both conferences clearly established the importance of women's health and nutritional status as key elements for the future of any society.

Although women represent half the world's population and contribute greatly to the functioning of society, most live under unfavorable conditions. Gender discrimination, lack of autonomy, and fewer opportunities for education and employment are some of the problems faced by women around the world. "Women have different and unequal access to and use of basic health resources, including primary health services for the prevention and treatment of childhood diseases, malnutrition, anemia, diarrheal diseases, communicable diseases, malaria and other tropical diseases, and tuberculosis..." (United Nations, 1995). In societies with one or more of these problems, malnutrition of women may be a reality from the time of conception to old age. Unfortunately, women's malnutrition is not only insufficiently recognized, but also inadequately documented. "Statistical data on health are often not systematically collected, desegregated and analyzed by age, sex and socioeconomic status and by established demographic criteria used to serve the interests and solve the problems of the subgroup... Recent and reliable data on the mortality and morbidity of women and conditions and diseases particularly affecting women are not available in many countries" (United Nations, 1995).

The nutritional status of mothers is usually assessed by measures of maternal anthropometry, maternal mortality, incidence of low birth weight, and anemia. Maternal mortality is much higher in developing countries: in Africa the lifetime chance of maternal death is 1:20 compared with 1:6,000 in North America. Of the four major causes of maternal mortality (hemorrhage, infection, obstructed labor, and eclampsia) three are preventable with appropriate nutritional responses in the population (United Nations, 1992). Maternal anthropometric indicators are useful for "...screening women at nutritional risk, monitoring maternal nutrition status, and predicting unfavorable infant outcomes related to pregnancy (low birth weight); perinatal, neonatal and infant mortality; and poor infant growth" (Krasovec and Anderson, 1991). Very often, height is a good indicator of socioeconomic status and is useful for identifying women at nutritional risk, while prepregnancy weight is closely associated with birth weight and infant mortality (Kramer, 1987; Naeye, 1979; Kardjati et al., 1988; Krasovec and Anderson, 1991).

The 1992 Second Report on the World Nutrition Situation, by the Administrative Committee on Coordination/Subcommittee

on Nutrition, presented results on stature, weight, and thinness of women in developing countries by region (United Nations, 1992). The report indicates that for the period 1977 to 1990, the prevalence of short stature and underweight among women in Asia and Latin America was substantial, especially compared with developed regions. However, the overall proportion of underweight women (below 45 kg) was high in South Asia (60 percent), Southeast Asia (45 percent), and sub-Saharan Africa (about 20 percent). The report also relates these findings to obstetric risk and the occurrence of low birth weight and, therefore, maternal mortality. Because deficiencies in height and weight can be due to both stunting and thinness, the results of the body mass index (BMI), which controls for height, "... show substantial prevalence of thinness in Southeast Asia (around 40 percent), and a significant prevalence in Africa of around 20 percent." Thus, underweight among women in Africa is mostly thinness, in line with the low prevalence of stunting. In Central America, the problem is more one of stunting than thinness. Most data on which this and other studies are based consist of small samples that do not allow analysis of socioeconomic and demographic differentials in the prevalence of female malnutrition.

The Demographic and Health Surveys (DHS) program, funded by the U.S. Agency for International Development, has assisted developing countries to implement surveys on population and maternal and child health since 1984. During the first phase of the program (DHS-I) from 1984 to 1989, surveys were implemented in 30 countries in sub-Saharan Africa, Asia, the Near East, North Africa, and Latin America and the Caribbean. Although anthropometric measurements have always been included in the DHS questionnaire, in the first phase measurements were obtained only for children born in the five years preceding the survey. During the second phase (DHS-II) from 1988 to 1993, with the support of the United Nations Food and Agricultural Organization, the DHS program expanded anthropometric measurements to include mothers of children born in the five years preceding the survey. The exercise was carried out in 11 of the 22 surveys completed during the second phase and included measurement of height, weight, and arm circumference. At the beginning of the third phase (DHS-III) from 1992 to 1997, it was decided to include maternal anthropometry in all scheduled surveys. Given that DHS samples are nationally representative for women with children born in the five years before the survey, population-based estimates of maternal nutritional status can be produced for the countries included in this phase. The main findings of these measurements are included in the DHS country reports.

The main objective of this report is to present comparative, maternal anthropometric data for DHS-II and DHS-III countries that can be related to the nutritional status of women in developing countries, as well as differentials in levels of nutritional status

by selected demographic, socioeconomic, and health-related characteristics. Only findings based on anthropometric indicators derived from the measurement of women's height and weight are presented. Section 2 in the report presents the survey data and discusses the methodology used in the surveys. Section 3 examines data quality. Section 4 describes the main anthropometric indicators: height, weight, relative weight, BMI, and Rohrer index. Sections 5 and 6 present the biodemographic and socioeconomic differentials of maternal malnutrition. Section 7 uses multivariate analysis to examine chronic energy deficiency and obesity. Section 8 presents the summary and conclusions.

2 Data and Methods

2.1 SAMPLE OF WOMEN

In most DHS surveys data are obtained from a sample of households and all women age 15-49 present in the households (de facto population). However, in some countries in the Near East/North Africa region information is restricted to ever-married women. The health component of the women's questionnaire is devoted to maternal and child health and includes anthropometric measurements of mothers and children. Health information is collected for mothers and their children born in the five years preceding the survey. In the second phase of the DHS program (DHS-II) the United Nations Food and Agricultural Organization (FAO) provided funds to collect anthropometric data on mothers and children in 10 surveys. In the third phase of the program (DHS-III) maternal anthropometric measurements were included as part of the standard questionnaire.

Self-weighted samples are used most often in DHS surveys; however, oversampling may be necessary in some areas to obtain reliable estimates. In this report weighted data are used in the analysis. The number of respondents ranges from 4,500 to 16,000, including 2,000 to 6,000 women with children under five years of age.² To avoid the bias of weight changes experienced by women during pregnancy and after delivery, the sample is further restricted to nonpregnant women and women with children three months of age and older. Results are presented for the following 18 countries:

Sub-Saharan Africa

Burkina Faso, 1992-93
Ghana, 1993
Kenya, 1993
Malawi, 1992
Namibia, 1992
Niger, 1992
Senegal, 1992-93
Tanzania, 1991-92
Zambia, 1992
Zimbabwe, 1994

Near East/North Africa

Egypt, 1992
Morocco, 1992
Turkey, 1993

Latin America/Caribbean

Bolivia, 1993-94
Colombia, 1990
Dominican Republic, 1991
Guatemala, 1995
Peru, 1991-92

2.2 EQUIPMENT AND TRAINING OF MEASURERS

The selection of measurers was carried out differently in different regions. The typical approach in Francophone African countries was to train all interviewers to take measurements of mothers and children. In Anglophone Africa and in Asia, two team members were usually designated as measurers. In most Latin American and Caribbean countries, the supervisor and field editor of each team were trained to take measurements, with the interviewers acting as assistants.

Training followed the guidelines in the United Nations manual, *How to Weigh and Measure Children* (United Nations, 1986). The guidelines and instruments (scales and measuring boards) were adapted to measure both mothers and children. Training included classroom instruction and field practice, and was conducted by a DHS specialist or by local personnel with expertise in nutrition. A quality-control test was administered at the end of the training to ensure trainee proficiency. In some countries, a second quality-control test was conducted halfway through the survey.

A digital scale was used to weigh the mothers and children, and measurers were taught to read weights to 100 grams. Height was measured using an adjustable wooden measuring board and measurers were instructed to read heights to the nearest 0.1 centimeter. For a limited number of countries, the women's arm circumference was measured using a metric band designed for this purpose. However, arm circumference was not collected during DHS-III because of observed inconsistencies with malnutrition estimates based on height and weight. For this reason, arm circumference information is not included in this report.

2.3 NUTRITIONAL STATUS INDICES AND INDICATORS OF MALNUTRITION

The use and analysis of maternal anthropometric data are limited because there is no accepted international standard or reference population for adult women. The nutritional status of children in DHS surveys is compared with an international reference population defined by the U.S. National Center for Health Statistics (NCHS) and accepted by the Centers for Disease Control (CDC) and the World Health Organization (WHO). The reference population is based on the assumption that well-nourished young children in all populations follow similar growth patterns (see Martorell and Habicht, 1986; and Sommerfelt and Stewart, 1994). A reference population serves as a point of comparison, facilitating the examination of differences in the anthropometric status of subgroups in a population and of changes in nutritional status over time.

² The reference period is 3 years for Bolivia, Ghana, and Zimbabwe.

Efforts were made in the past to develop anthropometric standards for adult populations. The most commonly used standard of ideal weights, known as the Fogarty standard, was developed by the Metropolitan Life Insurance Company and is based on adult mortality over age 25. Another standard was developed using the NCHS/CDC/WHO reference population for children (extrapolated to older ages) and the table of average body weight according to sex, height, and age prepared by the Association of Life Insurance Directors and the Actuarial Society of America. Unfortunately, these standards are affected by methodological limitations that preclude their use in comparative studies.

More recently, DHS has developed a de facto anthropometric standard for mothers in developing countries. The standard is based on "elite" women with children under five years of age in 12 DHS countries where maternal anthropometry was collected (Nestel and Rutstein, 1997). The DHS data were collected between 1991 and 1993 in Burkina Faso, the Dominican Republic, Egypt, Kenya, Malawi, Morocco, Peru, Namibia, Niger, Senegal, Tanzania, and Zambia. The elite group of mothers was defined as having the following characteristics: attended at least secondary school; came from a household that owns either a car or motorbike; and live in a home which has both electricity and a refrigerator. In Malawi and Kenya, the motorbike and refrigerator information was replaced by information about the presence of a flush toilet in the household.

When the DHS de facto standard is used, results can be presented two ways: as the percentage of women with chronic energy deficiency, and as the percentage of women who are obese. Women with chronic energy deficiency are those whose weight-for-height is less than 80 percent of that of the standard group, while obese women are those whose weight-for-height is more than 120 percent of that of the standard group.

Alternatively, some indices can be used that compare anthropometric measurements without use of a reference population. The most common indices based on body mass that use the weight-for-height ratio are: the Quetelet Body Mass Index (BMI), determined by dividing the weight in kilograms by the square of the height in meters; and the Rohrer Index, determined by dividing the weight in kilograms by the cube of the height in meters. The BMI has been used to measure chronic energy deficiency at values below 18.5 (James et al., 1988), overweight at values between 24.0 and 29.9, and obesity at values of 30 or more. The Rohrer Index, which is primarily used for school-age children, has cutoff points at 10.5 for malnutrition and 19.7 for obesity.

Given the comparative nature of this report, results are presented and analyzed using BMI estimates and in some cases BMI and height estimates or the DHS standard. Height is used to indicate the percentage of mothers who are stunted, that is the percentage of mothers with height less than 145 centimeters. For most DHS countries, BMI estimates of chronic energy deficiency and obesity fall between the Rohrer and DHS standard estimates at the cutoff points shown below (see also Section 4, Table 4.1). Discrepancies are primarily due to the lack of coincidence in the cutoff points for measuring chronic energy deficiency and obesity. For this reason, and given that BMI estimates provide middle values, this analysis is based entirely on BMI estimates.

	Chronic energy deficiency	Obesity
BMI	< 18.5	> 30.0
Rohrer	< 10.5	> 19.7
DHS Standard	< 80%	> 120%

3 Data Quality

Several issues regarding data quality may affect the interpretation of anthropometric findings. It is important to know whether the women who were measured are representative of the larger population of women of reproductive age, the extent to which all targeted women were measured, and whether the height and weight measurements are accurate.

3.1 SAMPLE BIAS

In DHS surveys, height and weight measurements are obtained for women of reproductive age (15-49) who have had a birth in the five years preceding the survey.³ These selection criteria produce a sample that is biased toward certain groups in the population. The sample bias, or selectivity, is perhaps most noticeable regarding age, with greater representation of women age 20-34, who have higher levels of fertility. Table 3.1 shows the difference between the percentage of women measured and the percentage of women observed in the total sample, by socio-demographic characteristics. In Bolivia, for example, the proportion of women age 20-24 who were measured is 6 percentage points greater than the proportion in that age group among all women in the sample. The pattern of selectivity by age of the mother is similar for all DHS countries, and includes age group 35-39 in countries with high levels of fertility (mostly in Africa). In Egypt and Turkey, the bias is less marked for women 15-19 because the sample only includes ever-married women.

Rural women and women who have lower levels of education tend to have greater representation in the overall sample; these are the same groups that have higher levels of fertility. Additionally, women of parity 1 are measured more often than women of other parities, which is expected since only women who have had births in the five years preceding the survey are measured. Women in union (married or living together) are also overrepresented in the sample of women measured because most births occur in this group. Finally, women whose last-born child is living tend to have greater representation compared with those who report that their last-born child is dead. There are no variations by country in the patterns described above, and the selectivity of women is mostly due to the effects of fertility on sample designs. The patterns described before do not present important variations between countries. We can conclude then, that the selectivity of women observed in the samples analyzed are due to the existing levels of fertility and to the sampling strategy used in each country. In sum, it is important to emphasize that the analysis focuses on the nutritional status of women with births in the five years before the survey, particularly their prepregnancy nutritional status (i.e., if they were to get pregnant at the moment of the survey). Any generalization of the findings to all women in the samples should be given careful consideration.

3.2 SAMPLE COVERAGE

The women measured in the DHS surveys do not necessarily represent all women of reproductive age; they account for, at most, two-thirds of the women (Table 3.2). In countries such as Burkina Faso and Niger that have high levels of fertility, close to two-thirds of eligible women were measured, compared with about one-third in Latin American countries.

One reason to permanently include the anthropometric measurement of women in the DHS questionnaire is the success achieved in obtaining the measurements. With the exception of the Latin American countries, the proportion of eligible women measured is 95 percent or more. The highest proportion of eligible women not measured was in Bolivia (13 percent), and the lowest was in Morocco (1 percent) (Table 3.2).

Nonmeasurement of women usually occurs either because the women were not present at the time the measurements were taken, or because they refused to be measured (Table 3.3). In Bolivia, almost half of the women who were not measured (49 percent) were not present, 39 percent refused to be measured, and 12 percent were not measured for other reasons. The level of nonmeasurement, although important in some cases, generally has little effect on the overall findings and conclusions of this report.

One way to assess the potential impact of women not being measured is to observe the levels of nonmeasurement by socio-demographic characteristics (Table 3.2). In Bolivia, which has the highest percentage of nonmeasurement, there are no substantial differences by age of the woman, place of residence, or parity, although older women and urban women have somewhat higher levels of nonmeasurement. Women with higher education, as expected, show a higher proportion of nonmeasurement. Also, women whose last child was dead at the time of the survey, have a higher percentage of nonmeasurement, in part because their child was not measured. These differentials appear to be important for some countries, especially in Latin America, and could affect the nutritional status differentials of women in the sample.

3.3 ACCURACY OF THE MEASUREMENTS

It is possible that a systematic bias in reading or recording the height and weight measurements could occur. While it is difficult to assess the accuracy of the recorded measurements, height and weight data can be examined to determine the extent of digit preference (i.e., heaping) on the commonly preferred decimals 0 and 5. According to Tables 3.4 and 3.5, heaping is not a problem in most of the DHS surveys analyzed. If no heaping occurs, about 20 percent of measurements should end in 0 or 5.

³ Three years in Bolivia, Ghana, and Zimbabwe. In Egypt and Turkey only ever-married women were measured.

Table 3.1. Difference between the percentage of women measured and the percentage observed in the total sample

Characteristic	Sub-Saharan Africa										Near East/North Africa					Latin America/Caribbean			
	Burkina Faso	Ghana	Kenya	Malawi	Namibia	Niger	Senegal	Tanzania	Zambia	Zimbabwe	Egypt	Morocco	Turkey	Bolivia	Colombia	Dom. Republic	Guatemala	Peru	
Mother's age																			
15-19	-13.6	-10.3	-15.8	-12.0	-14.8	-11.0	-14.5	-14.1	-14.6	-14.4	-0.2	-20.1	0.4	-12.7	-11.7	-14.6	-14.6	-16.5	
20-24	4.9	4.8	5.7	5.5	4.6	5.1	2.9	5.6	6.6	10.8	5.3	-1.8	13.1	6.4	8.8	7.6	6.7	3.2	
25-29	6.6	7.3	8.8	5.5	6.3	7.4	6.4	7.7	6.5	6.9	9.6	6.4	12.0	10.1	12.3	13.5	9.0	10.2	
30-34	4.3	6.2	5.1	4.2	5.7	3.8	5.9	4.2	3.9	5.2	4.2	10.9	1.2	4.5	4.6	5.8	6.6	7.3	
35-39	2.3	0.0	1.5	1.2	2.0	0.3	3.2	2.1	1.5	0.1	-2.2	6.8	-7.0	2.2	-1.2	-1.6	1.3	3.3	
40-44	-1.0	-2.8	-1.9	-1.2	-0.2	-1.8	-0.6	-0.9	-0.7	-2.8	-7.0	1.1	-10.0	-3.8	-5.4	-5.3	-2.9	-1.9	
45-49	-3.5	-5.3	-3.4	-3.1	-3.6	-3.9	-3.4	-4.4	-3.2	-5.8	-9.6	-3.3	-9.6	-6.6	-7.3	-5.5	-6.0	-5.5	
Residence																			
Urban	-4.6	-9.1	-3.5	-2.6	-2.6	-1.7	-7.5	-2.5	-4.3	-5.5	-5.7	-10.5	-1.7	-9.0	-6.9	-6.6	-8.3	-12.5	
Rural	4.6	9.1	3.5	2.6	2.6	1.7	7.5	2.5	4.3	5.5	5.7	10.5	1.7	9.0	6.9	6.6	8.3	12.5	
Education																			
No education	4.6	5.1	0.6	4.1	2.5	1.5	8.1	0.7	0.9	1.5	0.3	15.2	-0.1	2.1	0.9	2.0	8.2	3.4	
Primary	-1.4	-0.6	0.7	-3.1	0.7	-0.4	-3.9	1.0	2.2	2.7	-1.8	-5.4	-0.7	10.4	4.7	0.4	1.4	9.6	
Secondary	-3.1	-3.7	-1.2	-1.0	-2.8	-1.1	-3.9	-1.8	-3.1	-4.2	1.5	-9.2	1.3	-8.9	-3.3	-2.4	-8.4	-5.4	
Higher	-0.2	-0.8	-0.1	0.0	-0.3	0.0	-0.3	0.1	0.0	0.0	0.1	-0.7	-0.4	-3.5	-2.2	-0.1	-1.2	-7.6	
Parity																			
1	1.4	0.9	2.1	1.1	2.1	0.1	0.6	1.2	1.1	4.4	4.5	1.1	12.4	2.9	8.2	7.3	2.7	3.8	
2-3	1.3	2.7	1.7	-0.1	-1.2	0.7	0.2	1.9	1.5	3.2	1.7	2.4	-3.9	-0.5	-2.6	1.9	-0.3	-1.0	
4-5	0.2	0.0	-0.0	0.0	-0.5	0.9	1.0	-0.4	-0.3	-3.6	-2.3	-0.3	-5.6	-1.7	-3.9	-3.8	-2.4	-1.9	
6+	-2.9	-3.7	-3.7	-1.0	-0.4	-1.7	-1.7	-2.7	-2.4	-4.0	-3.9	-3.2	-2.8	-0.7	-1.7	-5.5	0.0	-0.9	
Marital status																			
Never married	-12.7	-17.1	-20.2	-13.2	-13.3	-9.6	-20.8	-16.2	-17.6	-21.4	0.0	-39.1	0.0	-25.2	-23.8	-27.8	-25.4	-33.4	
Married	13.2	17.7	19.6	12.5	8.7	10.5	21.4	16.2	17.5	24.6	5.4	41.4	2.7	16.8	6.8	6.2	15.4	17.2	
Living together	0.0	3.4	0.8	0.8	4.3	0.0	0.1	0.5	0.6	0.0	0.0	0.0	0.0	11.2	17.4	19.0	11.2	16.2	
Widowed	-0.3	-1.1	-0.5	0.1	0.1	-0.4	-0.2	-0.4	-0.1	-2.0	-4.1	-1.4	-1.7	-1.4	-0.6	-0.8	-0.7	-0.5	
Divorced	-0.2	-2.4	0.1	0.0	0.0	-0.5	-0.5	-0.1	-0.8	-1.2	-1.3	-1.0	-0.9	-0.5	-0.1	-0.7	-0.2	-0.2	
Not living together	0.0	-0.3	0.3	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	-0.2	-0.8	0.3	4.0	-0.2	0.8	
Survival status																			
Living	2.9	9.1	1.9	2.6	1.1	1.0	3.7	2.9	-0.1	1.3	10.5	1.4	10.6	6.5	2.3	3.3	3.0	0.9	
Dead	-2.9	-9.1	-1.9	-2.6	-1.1	-1.0	-3.7	-2.9	0.1	-1.3	-10.5	-1.4	-10.6	-6.4	-2.3	-3.3	-3.0	-0.9	

Table 3.2. Percentage of women with children born in the 5 years before the survey who were not measured

Percentage of women with children born in the 5 years before the survey who were not measured, by sociodemographic characteristics, Demographic and Health Surveys, 1990-1995																	
Characteristic	Near East/North Africa										Latin America/Caribbean						
	Sub-Saharan Africa										Co-lombia		Guatemala		Peru		
	Burkina Faso	Ghana ¹	Kenya	Malawi	Namibia	Niger	Senegal	Tan-zania	Zim-babwe ¹	Egypt	Morocco	Turkey	Bolivia ¹	Co-lombia	Dom. Republic	Guatemala	Peru
Women interviewed	6,354	4,562	7,540	4,849	5,421	6,503	6,310	9,238	7,060	6,128	9,062	6,519	8,603	11,140	7,320	12,403	15,882
Not to be measured	34.8	56.6	47.8	41.1	51.0	35.4	44.0	42.5	43.6	64.8	43.5	57.6	64.4	66.2	64.4	54.2	63.1
To be measured (%)	65.2	43.4	52.2	58.9	49.0	64.6	56.0	57.5	56.4	35.2	56.5	36.6	42.4	33.8	35.6	45.8	36.9
Not measured (%)	2.0	2.8	5.6	2.7	2.9	2.3	1.6	2.0	1.6	2.4	4.6	1.1	4.0	5.8	9.6	4.8	8.1
Percentage not measured according to:																	
Mother's age																	
15-19	1.5	3.4	6.1	1.7	3.1	1.6	1.4	3.4	1.7	1.4	4.2	1.9	3.9	11.9	5.2	11.0	4.5
20-24	1.8	3.1	4.3	3.7	3.4	2.5	0.4	2.0	1.4	2.2	3.3	1.1	4.7	11.6	6.7	11.1	4.5
25-29	1.5	1.8	5.7	2.6	1.7	1.8	1.8	2.3	1.7	2.3	4.9	0.7	4.1	12.1	6.0	7.7	7.0
30-34	2.2	2.9	5.1	3.1	2.6	2.5	1.7	1.6	1.5	2.9	5.2	1.1	2.8	13.7	5.1	12.1	4.7
35-39	1.7	3.2	5.9	0.6	2.4	1.6	2.1	1.6	0.9	3.4	4.5	0.8	4.2	13.8	4.4	5.6	10.3
40-44	3.9	2.3	8.6	3.8	3.3	3.4	1.3	1.4	3.1	3.1	5.5	1.3	6.7	14.1	5.7	10.0	9.0
45-49	4.2	2.5	10.8	3.5	6.2	5.1	1.1	1.8	2.3	0.0	6.2	0.8	0.0	19.6	7.8	0.0	21.3
Residence																	
Urban	2.9	2.6	11.7	3.0	3.9	2.9	2.0	2.4	1.8	3.1	6.5	1.3	4.5	13.7	7.3	10.8	5.6
Rural	1.8	2.7	4.5	2.5	2.2	2.1	1.2	1.9	1.5	2.2	3.3	0.8	3.4	11.6	2.5	7.7	4.2
Education																	
No education	1.9	3.6	6.6	2.4	2.2	2.2	1.3	1.6	2.5	3.3	4.1	0.7	3.8	13.7	5.6	9.4	5.3
Primary	2.1	2.0	5.4	3.1	3.2	2.3	1.7	2.1	1.6	2.1	3.8	1.0	3.5	13.1	4.0	8.4	3.4
Secondary	3.1	2.0	5.1	3.3	2.6	2.5	1.6	2.7	0.9	2.1	6.2	2.8	5.2	10.4	6.0	10.6	6.7
Higher	8.3	6.7	11.1	*	2.3	*	18.2	10.5	*	12.1	7.2	3.9	11.8	21.9	13.2	12.7	13.2
Parity																	
1	2.0	3.0	6.8	2.0	3.5	2.1	1.6	2.4	2.2	1.6	5.7	1.4	6.5	14.7	7.6	13.0	5.1
2-3	1.9	2.4	4.8	3.8	2.5	2.0	1.2	2.7	1.1	3.0	4.5	1.4	2.4	10.9	5.1	8.4	5.2
4-5	1.8	2.9	4.5	2.1	2.8	2.2	1.5	1.7	2.1	2.9	4.1	0.5	4.6	12.7	4.7	8.0	4.1
6+	2.2	2.7	6.4	2.7	2.7	2.5	1.5	1.1	1.5	2.0	4.6	0.7	3.2	13.6	3.7	8.0	4.2
Marital status																	
Never married	0.0	2.1	7.9	1.4	2.8	5.1	1.3	1.4	2.3	3.4	0.0	0.0	0.0	9.6	5.0	4.8	5.5
Married	2.0	2.5	5.2	2.4	2.8	2.3	1.4	2.0	1.6	2.3	4.6	0.9	4.1	12.5	7.2	8.8	4.8
Living together	0.0	2.4	1.3	6.1	2.6	0.0	0.0	2.4	1.0	0.0	0.0	0.0	0.0	22.2	4.1	9.2	4.3
Widowed	3.6	16.7	7.0	4.1	2.4	3.0	6.5	2.3	3.0	3.0	8.6	3.8	0.0	20.0	3.3	0.0	4.1
Divorced	0.0	1.6	11.1	4.7	5.6	3.0	2.1	2.1	0.8	3.5	8.6	1.2	11.1	10.0	0.0	23.1	12.5
Not living together	0.0	7.8	7.8	4.7	3.2	3.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	21.4	8.4	12.0	5.4
Survival status																	
Living	1.8	1.8	5.0	2.5	2.5	2.1	0.9	1.4	1.1	2.2	4.6	0.7	3.8	11.2	5.6	9.4	4.3
Dead	2.3	14.2	10.1	3.6	6.1	2.7	4.8	5.7	3.7	4.5	5.8	3.7	7.5	28.7	10.2	13.5	8.8
																	7.5
																	15.0

¹ For the 3 years before the survey.

* Less than 25 cases.

Heaping of height measurements (Table 3.4) appears in many countries: Bolivia (1.47), Guatemala (1.45), Burkina Faso (1.62), Namibia (1.74), Zambia (1.64), Zimbabwe (1.73), Morocco (2.01), and Turkey (1.81), with about equal preference for the digits 0 and 5. The weight readings show little or no heaping, with a weight-heaping ratio always around 1 (Table 3.5). Zambia and Morocco are exceptions, with ratios of 1.23 and 1.28, respectively, due to heaping on 0.

Heaping of height measurements on the digits 0 and 5 may indicate systematic undermeasurement because the design of the measuring board is such that numbers on the scale above the mother's height cannot be seen. (The top part of the measuring board covers the numbers.) Regarding weight measurements, there is no reason to assume a direction in the bias caused by digit preference because numbers can be seen both above and below the actual weight on the scales. Heaping of height and weight measurements on the digits 0 and 5 did not present a problem in the surveys analyzed.

Table 3.3 Percent distribution of women not measured by reason

Percent distribution of women not measured by reason, Demographic and Health Surveys 1990-1995

Country	Percentage not measured	Reason for no measurement		
		Not present	Refused	Other
Burkina Faso	2.0	67	23	10
Ghana	2.8	54	42	4
Kenya	5.6	49	33	18
Malawi	2.7	38	23	39
Namibia	2.9	52	12	36
Niger	2.3	29	18	53
Senegal	1.6	47	7	16
Tanzania	2.0	3	10	87
Zambia	1.6	39	26	35
Zimbabwe	2.4	50	28	22
Egypt	4.6	68	28	4
Morocco	1.1	7	37	56
Turkey	4.0	11	60	29
Bolivia	12.7	49	39	2
Colombia	5.8	75	7	8
Dominican Republic	9.6	67	10	24
Guatemala	4.7	33	50	18
Peru	8.1	29	--	71

Table 3.4 Heaping of height readings

Heaping of height readings: Percentage of recorded heights ending with 0 and 5. Ratio of the proportion of recorded heights ending with 0 and 5 to the expected proportion, Demographic and Health Surveys, 1990-1995

Region and country	Percentage of height readings ending with:		Heaping ratio	Number of women measured
	0	5		
Sub-Saharan Africa				
Burkina Faso	17.6	14.9	1.62	4,318
Kenya	12.3	11.5	1.19	4,044
Ghana	14.9	11.3	1.31	1,980
Malawi	10.7	13.1	1.19	2,854
Namibia	21.0	13.9	1.74	2,656
Niger	12.2	13.5	1.29	4,197
Senegal	11.6	12.0	1.18	3,534
Zambia	18.5	14.3	1.64	3,891
Zimbabwe	20.2	14.3	1.73	2,155
Near East/North Africa				
Egypt	14.1	12.2	1.31	5,676
Morocco	24.0	16.2	2.01	3,387
Turkey	21.2	15.0	1.81	2,763
Latin America/Caribbean				
Bolivia	16.2	13.2	1.47	3,059
Colombia	10.1	10.5	1.03	4,071
Dominican Republic	11.5	10.7	1.11	2,609
Guatemala	14.3	14.8	1.45	5,679
Peru	11.7	10.5	1.11	5,868

Table 3.5 Heaping of weight readings

Heaping of weight readings: Percentage of recorded weights ending with 0 and 5. Ratio of the proportion of recorded weights ending with 0 and 5 to the expected proportion, Demographic and Health Surveys, 1990-1995

Region and country	Percentage of height readings ending with:		Heaping ratio	Number of women measured
	0	5		
Sub-Saharan Africa				
Burkina Faso	8.5	10.1	0.93	3,571
Kenya	10.0	10.3	1.01	3,445
Ghana	10.7	10.0	1.03	1,716
Malawi	8.3	9.8	0.90	2,259
Namibia	9.9	10.0	0.99	2,253
Niger	9.6	10.3	0.99	3,272
Senegal	10.0	10.9	1.05	2,859
Zambia	14.4	10.2	1.23	3,157
Zimbabwe	10.5	10.2	1.03	1,845
Near East/North Africa				
Egypt	9.5	12.1	1.08	4,864
Morocco	14.8	10.9	1.28	2,803
Turkey	10.5	11.0	1.08	2,402
Latin America/Caribbean				
Bolivia	11.9	9.0	1.05	2,584
Colombia	10.3	9.8	1.01	3,362
Dominican Republic	9.2	9.9	0.95	2,234
Guatemala	12.8	9.7	1.13	4,698
Peru	10.5	9.9	1.02	5,103

4 Findings

4.1 OVERALL LEVELS OF NUTRITION

The anthropometric measurements height and weight are used to estimate maternal nutritional status in DHS countries. A woman's nutritional status before pregnancy is an important determinant of the characteristics of the pregnancy for both mother and child and contributes to morbidity and mortality that may follow a birth. Maternal height is commonly associated with birth weight, child survival, maternal mortality, pregnancy and birth complications, and length of breastfeeding (Krasovec and Anderson, 1991). Women whose height is less than 145 cm are frequently found in high-risk categories for these variables. Table 4.1 presents the average height and body mass index (BMI) for women, and the percentage who are below or above the cutoff points for the anthropometric indicators of maternal nutritional status. On average, sub-Saharan women are the tallest, with Senegal and Burkina Faso at the upper end of the distribution (162.3 cm and 161.6 cm, respectively); Latin American women are the shortest, with Guatemala and Peru at the lower end of the distribution (148.2 cm and 150.3 cm, respectively). The largest proportions of women with height below 145 cm are in Guatemala (31 percent) and Peru (16 percent).

A woman's prepregnancy weight determines the characteristics of her pregnancy (weight gain, premature birth, etc.) and the birth weight of her child. Given the relationship between height and weight, use of the BMI is preferred over other indicators.⁴ Sub-Saharan women have the lowest BMI averages (i.e., tall and thin), compared with women in other regions. The lowest BMI average (20.7) is for women in Niger, while the highest (26.9) is for women in Egypt. This classifies the women in the two countries as having the highest proportions of malnutrition and obesity, respectively.

In Table 4.1, women are classified according to three BMI categories: < 18.5 for chronic energy deficiency; 25-29 for overweight; and 30+ for obesity. Women in sub-Saharan Africa are the most affected by chronic energy deficiency: 10 percent or more have a BMI below 18.5 (except for Zimbabwe), while in Latin America and Near East/North Africa the percentage is well below 10 percent. In Niger, for example, one-fifth of the women measured have chronic energy deficiency and, if they were to get

pregnant immediately, would be considered at high risk for unfavorable maternal outcome. At the other end of the distribution are overweight and obese women. This seems to be a general problem in the Near East and North Africa and, to a lesser extent, in Latin America, with more than a third of the women overweight. Obesity is most prevalent in Egypt and Turkey, with 18 percent or more of the women measured having a BMI of 30 or more. In Latin America, obesity is less prevalent but above the levels observed in sub-Saharan countries. Obesity is a risk factor for unfavorable pregnancy outcomes such as perinatal mortality, high birth weight, and infant mortality (Krasovec and Anderson, 1991). Obesity is also related to other degenerative diseases such as high blood pressure, heart attacks, and diabetes.

Another way of assessing maternal nutritional status is by comparing the observed weight-for-height index with the weight-for-height index of a standard reference population. Table 4.1 shows the percentage of women below and above the cutoff points for weight-for-height (< 80 and 120+), indicating the proportion whose weight-for-height is representative of the DHS standard distribution. In Bolivia, for example, 5 percent of the women have a weight-for-height that is less than 80 percent of the weight-for-height observed in the standard DHS distribution. At the other end of the distribution, 9 percent of the women have a weight-for-height that is 120 percent or more of the weight-for-height of the standard distribution. Using these cutoff points as indicators of chronic energy deficiency and obesity, it is evident that the weight-for-height information in Table 4.1 confirms the existence of high levels of chronic energy deficiency in sub-Saharan countries, high levels of overweight and obesity in the Near East and North Africa, and intermediate values for chronic energy deficiency and obesity in Latin America. Note, however, that the estimates for chronic energy deficiency based on the DHS standard are considerably higher than those based on the BMI. At the same time, obesity estimates are similar for both methods.

4.2 PATTERNS OF NUTRITION

Height

Figure 4.1 shows the patterns of stunting among women in the three regions. While these patterns represent a continuum, countries can be classified into two broad patterns. African and Near Eastern countries have a pattern of tall women and low proportions of stunted women. Latin American countries, especially Guatemala, Peru, and Bolivia, have a pattern of short women and high proportions of stunted women (except for the Dominican Republic).

⁴ The preference of BMI over weight-for-height is based on the assumption that BMI is independent of height. Although BMI is correlated with height, the values tend to be low (below 0.10). At the same time, weight-for-height is expressed as a percentage of average or ideal body weight, while BMI is not.

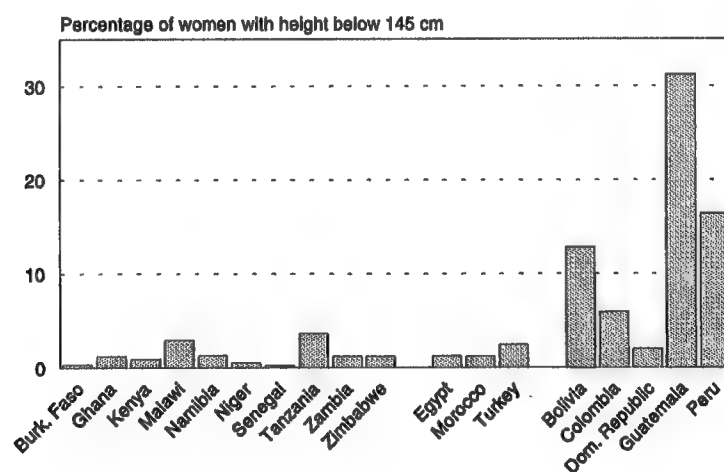
Table 4.1 Indicators of maternal nutritional status among women with children under 5 years

Mean height and BMI among nonpregnant women with children under 5 years, and percentage below and above the cutoff points for the anthropometric indicators of nutrition, Demographic and Health Surveys, 1990-1995

Region and country	Height (cms)		Rohrer		BMI (kg/m ²)						Weight-for-height ¹		Number of women
	Mean	< 145	< 10.5	19.7+	Mean	< 16.0	16-18.4	<18.5	25-29	30+	< 80	120+	
Sub-Saharan Africa													
Burkina Faso	161.55	0.3	3.9	0.7	21.00	1.0	13.6	14.7	5.8	1.0	23.8	1.4	3,031
Ghana	158.50	1.2	2.4	2.8	21.73	0.8	11.4	12.2	9.3	3.5	21.0	4.4	1,598
Kenya	159.14	0.9	2.1	2.0	21.99	0.6	9.3	9.9	11.8	2.5	17.0	3.4	3,059
Malawi	156.08	2.9	1.1	0.9	21.52	0.5	9.2	9.7	8.0	1.1	19.5	1.5	2,108
Namibia	160.55	1.3	3.5	5.3	22.59	1.4	12.5	13.9	13.8	7.6	18.4	8.3	2,093
Niger	160.31	0.5	5.9	0.8	20.74	2.2	17.4	19.6	6.6	1.4	27.5	2.1	2,973
Senegal	162.28	0.2	5.2	1.8	21.86	1.5	13.6	15.1	12.2	3.8	20.0	5.3	2,683
Tanzania	155.86	3.6	1.3	1.6	21.70	0.6	9.2	9.8	9.4	2.0	19.4	3.5	4,115
Zambia	158.05	1.2	2.2	2.0	21.78	0.7	10.7	11.4	11.6	2.5	18.1	3.6	2,974
Zimbabwe	159.29	0.8	0.8	4.3	23.09	0.1	5.1	5.2	17.1	5.9	9.1	8.5	1,788
Near East/North Africa													
Egypt	157.04	1.22	0.4	21.1	26.88	0.2	1.4	1.6	33.9	23.9	3.5	28.5	4,518
Morocco	157.02	1.20	0.6	9.0	24.11	0.2	3.6	3.8	22.3	10.9	10.0	12.4	2,683
Turkey	155.31	2.43	0.3	16.8	25.81	0.0	2.6	2.6	31.5	18.4	4.1	23.8	2,275
Latin America/Caribbean													
Bolivia	151.03	12.8	0.3	8.4	24.25	0.2	2.3	2.5	25.3	8.0	4.8	8.9	2,211
Colombia	154.51	5.9	0.5	9.0	24.46	0.1	3.8	3.9	31.1	9.2	6.7	12.1	3,131
Dominican Republic	156.38	2.0	1.8	6.4	23.24	0.8	8.2	9.0	18.9	7.4	14.9	8.8	2,022
Guatemala	148.21	31.2	0.5	10.5	24.18	0.3	3.5	3.8	26.5	8.2	9.1	10.0	4,536
Peru	150.34	16.4	0.1	11.1	24.76	0.1	1.2	1.3	30.6	9.2	3.6	9.8	2,713

¹ Proportion of women with a weight-for-height that is < 80 or 120 + percent of the weight-for-height of the DHS standard distribution.

Figure 4.1 Stunting among women age 15-49 with children under 5 years, Demographic and Health Surveys, 1990-1995



BMI

Figure 4.2 shows three main patterns for estimates of chronic energy deficiency (BMI < 18.5) and obesity (BMI 30+). The African pattern (except for Ghana) has a high level of chronic energy deficiency but a low level of obesity. The Near East/North African pattern has a low level of chronic energy deficiency but a high percentage of obesity. Latin American countries show a third pattern characterized by a relatively low level of chronic energy deficiency (except for the Dominican Republic) and a moderate level of obesity.

Weight-for-Height

The same three patterns can be seen in Figure 4.3, which presents estimates of chronic energy deficiency and obesity based on weight-for-height information. Sub-Saharan countries have high levels of chronic energy deficiency and low levels of obesity (except for Namibia); Near East and North African countries have high levels of obesity but low levels of chronic energy deficiency; and Latin American countries show intermediate levels of chronic energy deficiency and obesity.

4.3 DISTRIBUTIONS OF THE MEASURES OF NUTRITIONAL STATUS

Graphing the distributions of the three measures of nutritional status (height, BMI, and weight-for-height), as shown in Figures 4.4 to 4.6, provides another picture of maternal nutritional status in the countries surveyed. In Figure 4.4, which shows the distribution of women according to height, the patterns seen in Figure 4.1 can again be identified: the sub-Saharan pattern (except for Malawi) of tall women is reflected in the curve shifted to the right; the Near East/North African pattern with a more balanced normal distribution; and the Latin American pattern which has two components—one seen in Bolivia, Guatemala, and Peru with a curve shifted to the left reflecting high levels of stunting, and one seen in the Dominican Republic

and Colombia that is closer to the Near East/North African pattern.

These patterns are also observed in the distributions of BMI and weight-for-height presented in Figures 4.5 and 4.6, respectively. The low level of chronic energy deficiency (BMI < 18.5) is marked among the Latin American countries, together with high proportions of stunted women (Bolivia, Guatemala, and Peru). Regarding the pattern for obesity, Near East/North African countries can be identified with the highest percentages at the end of the distributions, sub-Saharan African countries with the lowest, and Latin American countries in the middle of these two patterns. Tables 4.2, 4.3, and 4.4 show the percent distributions for each of the three indicators of nutritional status in the countries surveyed.

Figure 4.2 Chronic energy deficiency and obesity among women age 15-49, Demographic and Health Surveys 1990-1995

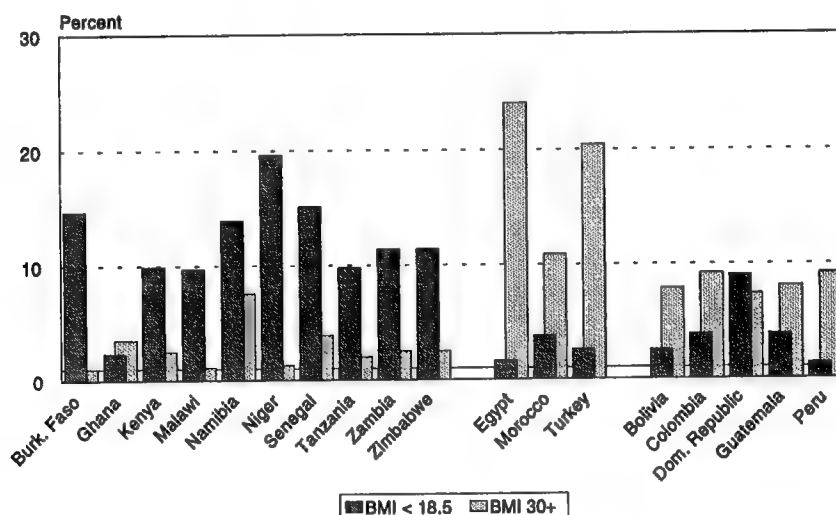


Figure 4.3 Weight-for-height among women age 15-49, Demographic and Health Surveys 1990-1995

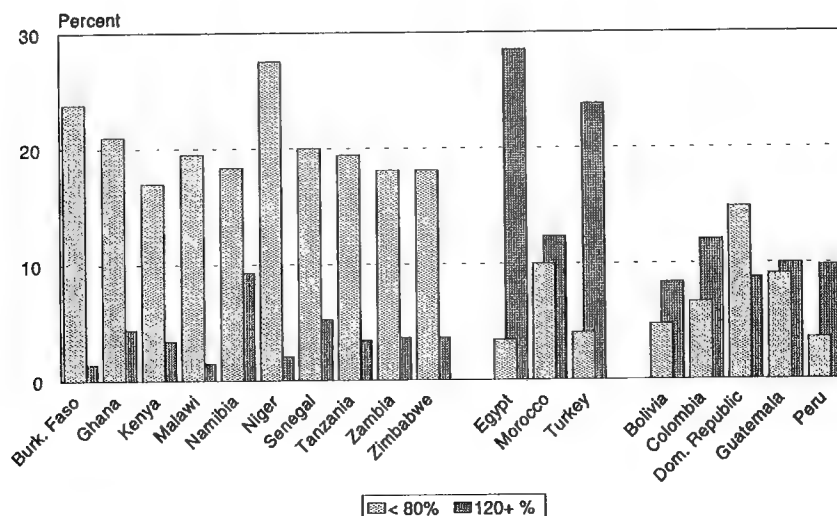


Figure 4.4 Distribution of women age 15-49 according to height scores, Demographic and Health Surveys 1990-1995

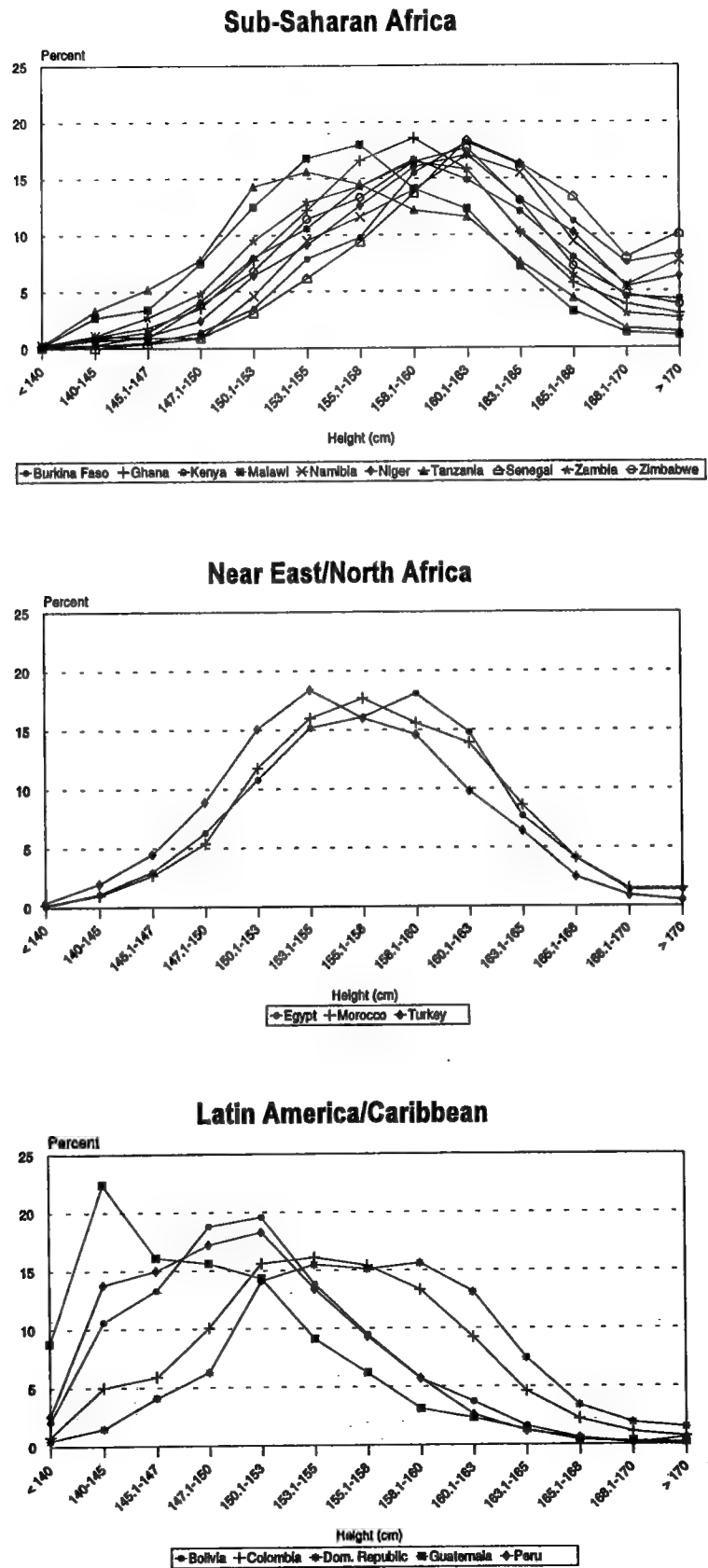


Figure 4.5 Distribution of women age 15-49 according to BMI scores, Demographic and Health Surveys 1990-1995

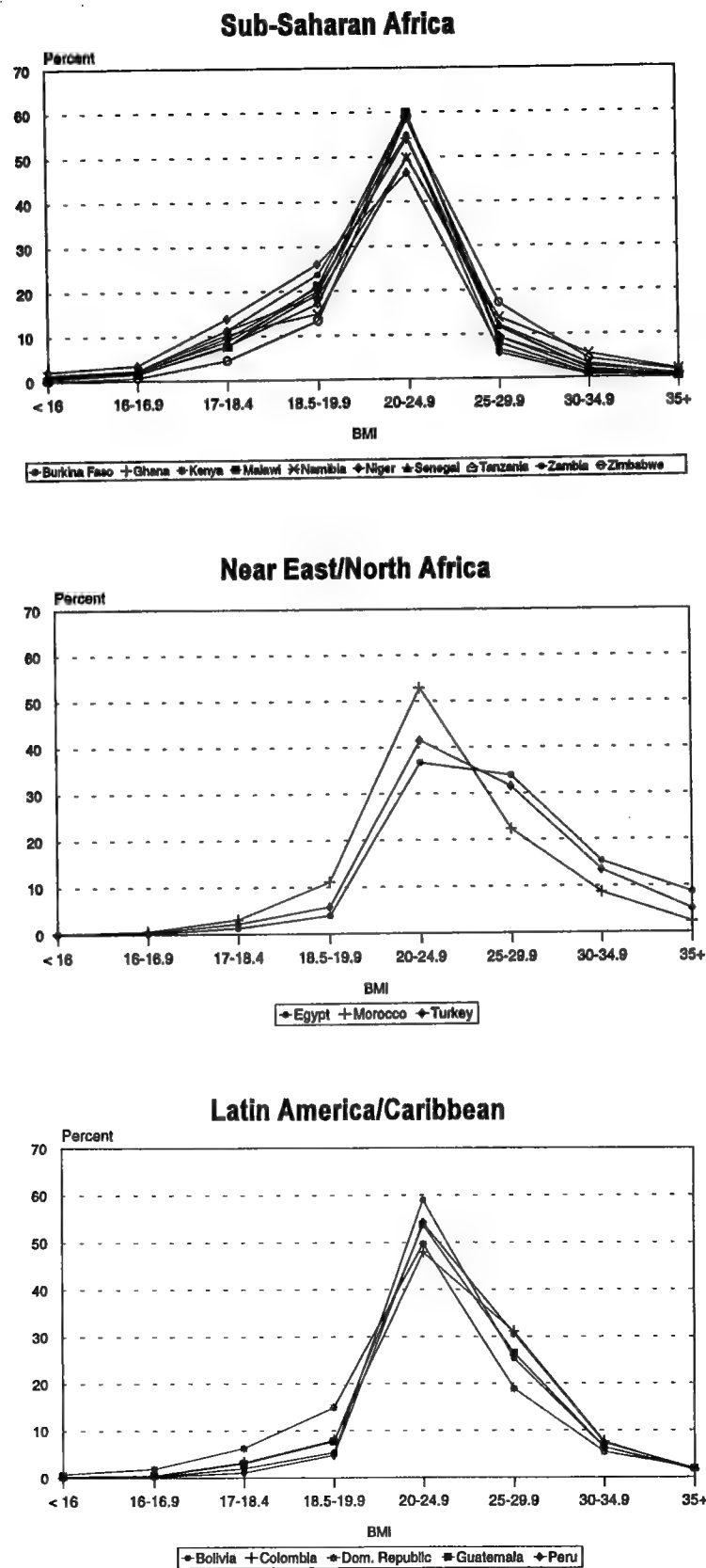


Figure 4.6 Distribution of women age 15-49 according to weight-for-height, Demographic and Health Surveys 1990-1995

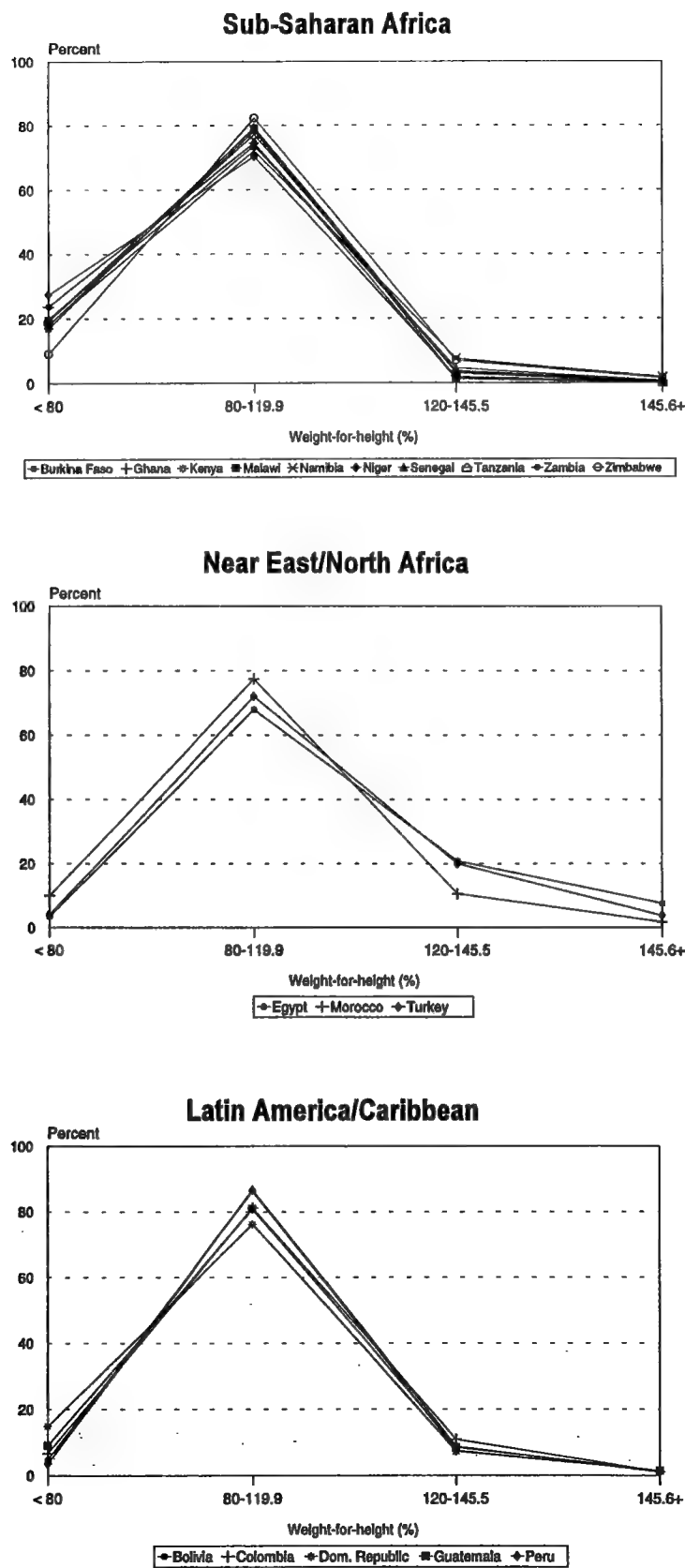


Table 4.2 Distribution of women with children under 5 years by height

Percent distribution of nonpregnant women age 15-49, with children born in the 5-year period preceding the survey, by height, Demographic and Health Surveys, 1990-1995

Region and country	Height (cm)														Total
	<140	142.5	145	147.5	150	152.5	155	157.5	160	162.5	165	167.5	170	>170	
Sub-Saharan Africa															
Burkina Faso	0.0	0.0	0.2	0.5	1.4	3.5	7.9	9.8	15.5	18.2	16.2	11.2	7.5	8.3	100.0
Ghana	0.2	0.2	0.8	1.8	3.5	7.8	12.2	16.6	18.6	15.8	10.2	5.7	3.8	3.0	100.0
Kenya	0.2	0.2	0.6	1.4	4.1	8.0	10.6	14.3	16.7	14.9	12.1	8.0	4.5	4.3	100.0
Malawi	0.2	0.5	2.2	3.4	7.5	12.5	16.8	18.0	14.1	12.3	7.2	3.2	1.2	1.1	100.0
Namibia	0.3	0.2	0.8	0.9	2.9	4.6	9.5	11.6	14.0	17.1	15.5	9.4	5.5	7.7	100.0
Niger	0.2	0.2	0.1	1.1	2.4	6.4	9.1	12.6	16.0	17.1	13.1	10.2	5.4	6.3	100.0
Senegal	0.1	0.0	0.0	0.4	0.9	3.1	6.2	9.4	13.7	18.4	16.3	13.4	8.0	10.1	100.0
Tanzania	0.2	1.2	2.1	5.2	7.8	14.3	15.6	14.5	12.2	11.6	7.6	4.4	1.7	1.4	100.0
Zambia	0.1	0.3	0.8	2.7	4.8	9.5	12.9	14.3	16.5	15.8	10.3	6.4	3.0	2.6	100.0
Zimbabwe	0.2	0.3	0.3	0.9	3.8	6.8	11.4	13.3	16.5	17.7	13.0	7.2	4.7	3.8	100.0
Near East/North Africa															
Egypt	0.1	0.3	0.8	3.0	6.3	10.8	15.2	16.1	18.1	14.8	7.7	4.1	1.4	1.4	100.0
Morocco	0.2	0.3	0.7	2.7	5.4	11.8	16.0	17.7	15.6	13.9	8.6	4.1	1.5	1.5	100.0
Turkey	0.4	0.5	1.5	4.5	8.9	15.1	18.4	16.0	14.6	9.8	6.4	2.5	0.9	0.5	100.0
Latin America/Caribbean															
Bolivia	2.1	3.4	7.2	13.3	18.8	19.6	13.8	9.5	5.7	3.7	1.6	0.6	0.1	0.6	100.0
Colombia	0.8	1.2	3.8	5.9	10.1	15.6	16.1	15.4	13.3	9.2	4.6	2.2	1.1	0.7	100.0
Dominican Republic	0.5	0.4	1.1	4.1	6.3	14.1	15.5	15.1	15.6	13.1	7.4	3.4	1.9	1.5	100.0
Guatemala	8.9	9.6	12.9	16.1	15.6	14.3	9.1	6.1	3.1	2.3	1.3	0.4	0.3	0.2	100.0
Peru	2.6	4.9	8.9	15.0	17.2	18.3	13.4	9.3	5.7	2.6	1.2	0.6	0.2	0.2	100.0

Table 4.3 Distribution of women with children under 5 years by BMI

Percent distribution of nonpregnant women with children born in the 5-year period preceding the survey by BMI, Demographic and Health Surveys, 1990-1995

Region and country	BMI								Total
	< 16	17	18.5	20	25	30	35	> 35	
Sub-Saharan Africa									
Burkina Faso	1.0	2.3	11.3	23.7	54.9	5.8	0.6	0.4	100.0
Ghana	0.8	1.8	9.6	20.7	54.2	9.3	2.7	0.8	100.0
Kenya	0.6	1.5	7.8	17.2	58.6	11.8	2.0	0.5	100.0
Malawi	0.5	1.6	7.6	21.3	60.0	8.0	0.9	0.2	100.0
Namibia	1.4	2.3	10.3	14.9	49.8	13.8	5.5	1.8	100.0
Niger	2.2	3.5	13.9	26.0	46.5	6.6	1.1	0.3	100.0
Senegal	1.5	2.3	11.3	18.9	50.0	12.2	3.2	0.6	100.0
Tanzania	0.6	1.5	7.7	19.4	59.4	9.4	1.5	0.5	100.0
Zambia	0.7	1.9	8.8	20.0	54.5	11.6	2.0	0.5	100.0
Zimbabwe	0.1	0.6	4.5	13.3	58.5	17.1	4.3	1.6	100.0
Near East/North Africa									
Egypt	0.2	0.1	1.3	3.9	36.7	33.9	15.3	8.6	100.0
Morocco	0.2	0.6	3.1	11.1	52.9	22.3	8.6	2.3	100.0
Turkey	0.0	0.3	2.2	5.8	41.5	31.5	13.4	5.0	100.0
Latin America/Caribbean									
Bolivia	0.2	0.3	2.0	5.4	59.0	25.3	6.4	1.6	100.0
Colombia	0.1	0.5	3.3	8.0	47.9	31.1	7.6	1.6	100.0
Dominican Republic	0.8	1.9	6.3	15.0	49.7	18.9	5.4	2.0	100.0
Guatemala	0.3	0.5	3.0	7.8	53.7	26.5	6.4	1.8	100.0
Peru	0.1	0.2	1.1	4.8	54.2	30.6	7.3	1.9	100.0

Table 4.4 Distribution of women with children under 5 years by weight-for-height

Percent distribution of nonpregnant women with children born in the 5-year period preceding the survey, by weight-for-height in percent, Demographic and Health Surveys, 1990-1995

Region and country	Weight-for-height (percent)				Total
	< 80	80-119.9	120-145.5	145.6 +	
Sub-Saharan Africa					
Burkina Faso	23.8	74.8	1.2	0.2	100.0
Ghana	21.0	74.6	3.8	0.6	100.0
Kenya	17.0	79.6	3.0	0.4	100.0
Malawi	19.5	79.1	1.4	0.1	100.0
Namibia	18.4	72.2	7.5	1.8	100.0
Niger	27.5	70.4	1.8	0.3	100.0
Senegal	20.0	73.8	4.6	0.7	100.0
Tanzania	19.4	77.3	3.1	0.2	100.0
Zambia	18.1	78.3	3.3	0.4	100.0
Zimbabwe	9.0	82.5	7.0	1.5	100.0
Near East/North Africa					
Egypt	3.5	68.0	20.9	7.6	100.0
Morocco	10.0	77.5	10.6	1.8	100.0
Turkey	4.1	72.1	20.0	3.8	100.0
Latin America/Caribbean					
Bolivia	4.8	86.4	7.5	1.4	100.0
Colombia	6.7	81.2	10.9	1.2	100.0
Dominican Republic	14.9	76.3	7.3	1.5	100.0
Guatemala	9.1	80.9	8.5	1.5	100.0
Peru	3.6	86.6	8.8	1.0	100.0

5 Biodemographic Differentials

This section examines the biodemographic differentials of maternal nutritional status. Biodemographic variables are grouped into two sets: fertility indicators and child health indicators. As noted earlier, this analysis is based entirely on estimates of chronic energy deficiency and obesity obtained from the BMI indicator, assuming that Rohrer and DHS standard estimates are below and above the BMI values, respectively.

5.1 FERTILITY-RELATED VARIABLES

Parity, pace of childbearing (birth intervals), length of the postpartum period, and duration of lactation all affect maternal nutritional status. The first two differentials—parity and pace of childbearing—are included to assess maternal depletion (which occurs in countries with high fertility levels). Duration of the postpartum period and mother's breastfeeding status (for the most recent birth) also affect maternal nutritional status.

Mother's Age

Analyzing the magnitude of chronic energy deficiency among women at different ages reveals how nutritional status varies during the reproductive years (see Table 5.1). Generally, BMI increases with age, mainly due to weight gain throughout the reproductive years. Figure 5.1 shows the percentage of mothers with BMI < 18.5 (chronic energy deficiency) by age for the three regions analyzed. Although the pattern by country and region is mixed, chronic energy deficiency occurs more commonly among younger mothers (age 15-24) than older mothers. In most of the sub-Saharan countries examined (except Kenya, Tanzania, and Zimbabwe), a greater proportion of mothers age 15-24 exhibit chronic energy deficiency than older mothers. The percentages are particularly high in Namibia, Niger, and Senegal. At the other end of the age distribution, that is, women age 40-49, there are high percentages of mothers with chronic energy deficiency in Ghana, Namibia, and Zambia.

Obesity (BMI 30+), as noted earlier, is common in the Near East/North African countries and tends to increase with age of the mother (Figure 5.2). Thus, by age 30, one-tenth of the mothers in Egypt and Turkey are obese, compared with 3 percent or less in the other DHS countries. Among mothers age 35 and over in Egypt and Turkey, more than one-third are obese, compared with 15 percent or less in the other DHS countries.

Parity

The relationship between parity (number of children ever born) and maternal nutritional status is presented in Table 5.2. There is a positive association between mother's parity and mean BMI; that is, as parity increases, so does the average BMI. Some chronic energy deficiency can be seen at higher parities but, for

most countries, the highest mean BMIs and the lowest levels of chronic energy deficiency are found at the highest parities. In Burkina Faso, Ghana, Niger, Zambia, Morocco, Bolivia, Colombia, the Dominican Republic, and Peru, chronic energy deficiency by mother's parity shows a U-shaped distribution, with high values at parity 1 and 6+ and low values at parity 4-5. This pattern may be an indication of long-term maternal depletion (see Figure 5.3). In sub-Saharan Africa, chronic energy deficiency varies by parity from 5 to 15 percent, with the exception of Niger and Senegal where chronic energy deficiency is prevalent among low parity mothers (20 to 25 percent). The lowest prevalence of chronic energy deficiency (less than 5 percent) is observed in Turkey and Peru among women who are parity 2 or above.

Part of the increase in the BMI observed by parity can be associated with obesity. The percentage of women with BMI 30+ (see Figure 5.4) increases up to parity 4-5, but in some countries declines among mothers who are parity 6+ (for example, in Latin American countries, and in Namibia, Egypt, and Morocco). The greatest weight gains (and associated increased BMI) are observed after parity 1 and are sustained through parity 5, especially in Turkey where the percentage of obese mothers increases from 9 percent at parity 1, to 27 percent or more at parity 4 and above.

Last Birth Interval

The length of the interval preceding each child's birth is derived from the birth history provided by the mother. Three categories are defined regarding birth intervals: first births, intervals of less than 24 months, and intervals of 24 months or more (see Table 5.3).

Almost all the countries show a consistent pattern linking malnutrition (chronic energy deficiency and obesity) with length of birth interval: high percentages of chronic energy deficiency are associated with short birth intervals while high percentages of obesity are associated with long birth intervals. The highest prevalence of chronic energy deficiency is observed among mothers with first births. In sub-Saharan countries the differences between the three categories—i.e., first birth, < 24 months, and 24+ months—are small and, in cases such as Burkina Faso, Kenya, Malawi, and Senegal there is no variation in BMI according to length of birth interval.

Postpartum Period

Women's BMI can be influenced by the postpartum period, during which maternal weight is affected by the duration of breastfeeding and lactation (Adair, 1991). In this report, the postpartum period is defined as the number of months since the last birth for women with children born in the five years preceding the survey (see Table 5.4). The prevalence of chronic energy

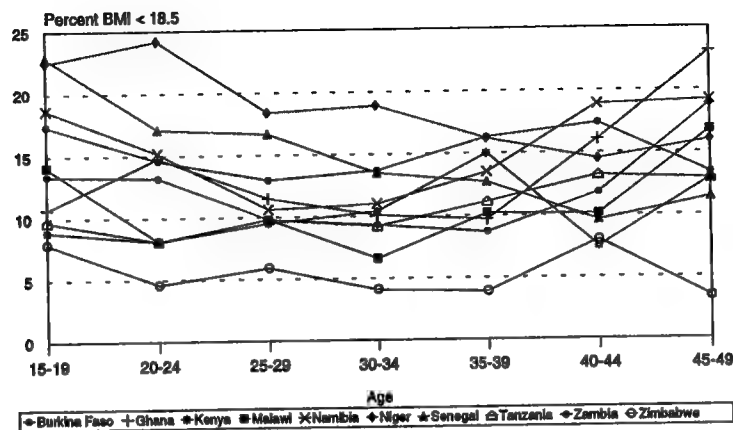
Table 5.1 Mean BMI among women with children under 5 years by age

Mean BMI among nonpregnant women with children born in the five years before the survey and percentage with BMI below and above the cutoff points for BMI, by age, Demographic and Health Surveys, 1990-1995

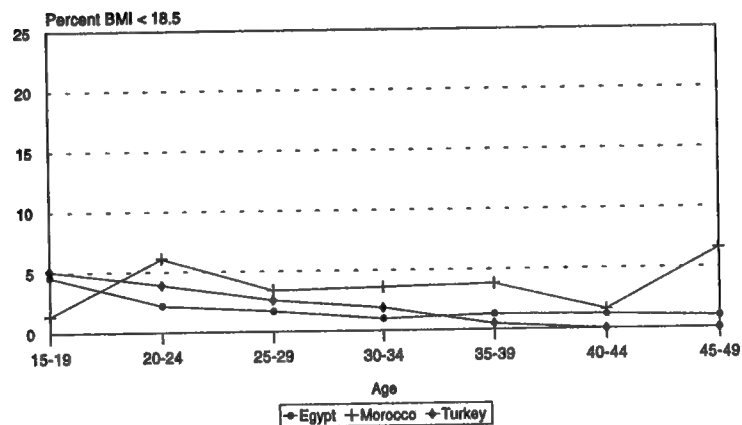
Region and country	Age group							Total
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	
Mean BMI								
Sub-Saharan Africa								
Burkina Faso	20.48	20.81	21.11	21.36	20.98	20.82	21.22	21.00
Ghana	20.97	21.10	21.73	22.28	22.29	21.94	21.23	21.73
Kenya	21.29	21.72	22.13	22.21	21.95	22.49	22.38	21.99
Malawi	20.96	21.47	21.53	21.79	21.71	21.48	21.47	21.52
Namibia	20.86	21.74	22.76	23.65	23.30	22.70	22.87	22.59
Niger	19.69	20.29	20.82	21.06	21.15	21.50	21.61	20.74
Senegal	20.26	21.18	21.46	22.18	22.86	22.80	22.88	21.86
Tanzania	21.50	21.53	21.70	21.99	22.02	21.46	21.41	21.70
Zambia	20.83	21.17	21.76	22.58	22.84	22.45	21.43	21.78
Zimbabwe	22.09	22.37	23.37	23.85	23.53	23.84	24.74	23.09
Near East/North Africa								
Egypt	23.92	25.00	26.32	27.62	28.09	29.17	28.03	26.88
Morocco	22.90	22.88	23.71	24.13	24.81	25.14	25.09	24.11
Turkey	23.23	24.19	25.88	26.68	28.13	27.99	27.24	25.81
Latin America/Caribbean								
Bolivia	22.62	23.57	24.30	24.72	25.11	25.16	24.34	24.25
Colombia	22.66	23.43	24.13	25.19	25.86	26.28	26.95	24.46
Dominican Republic	21.48	22.33	23.58	23.83	24.29	23.59	21.40	23.24
Guatemala	22.31	23.43	24.24	24.64	24.99	25.33	24.94	24.18
Peru	22.83	23.66	24.46	25.26	25.90	26.03	25.66	24.76
Percentage with BMI < 18.5								
Sub-Saharan Africa								
Burkina Faso	17.4	14.6	13.0	13.7	16.3	17.4	13.4	14.7
Ghana	10.7	14.8	11.5	10.1	9.7	16.1	23.1	12.3
Kenya	8.9	8.1	9.5	10.4	15.0	7.5	12.9	9.9
Malawi	14.1	8.1	9.8	6.6	10.2	10.1	16.8	9.7
Namibia	18.7	15.2	10.6	11.0	13.5	18.9	19.2	13.9
Niger	22.5	24.2	18.4	18.9	16.2	14.5	16.0	19.6
Senegal	22.9	17.1	16.7	13.5	12.7	9.6	11.4	15.1
Tanzania	9.7	8.1	9.8	9.2	11.1	13.2	12.9	9.8
Zambia	13.4	13.2	9.8	9.3	8.7	11.8	18.9	11.4
Zimbabwe	7.9	4.6	5.9	4.1	3.9	8.0	3.4	5.2
Near East/North Africa								
Egypt	4.6	2.2	1.7	1.0	1.3	1.2	1.0	1.6
Morocco	1.4	6.1	3.4	3.6	3.8	1.6	6.6	3.8
Turkey	5.1	3.9	2.6	1.9	0.5	0.0	0.0	2.6
Latin America/Caribbean								
Bolivia	5.8	3.3	2.5	1.3	1.1	2.3	0.0	2.5
Colombia	9.2	4.1	5.4	2.5	0.4	2.5	1.4	3.9
Dominican Republic	6.6	10.0	8.9	9.4	7.8	11.7	2.6	9.0
Guatemala	6.8	5.5	3.6	3.1	3.0	0.6	1.9	3.9
Peru	3.5	1.6	1.3	0.9	1.2	0.7	2.3	1.3
Percentage with BMI 30+								
Sub-Saharan Africa								
Burkina Faso	0.2	0.2	0.7	2.1	1.8	1.0	0.9	1.0
Ghana	0.0	1.7	2.9	4.2	6.8	6.3	5.1	3.5
Kenya	1.0	0.8	2.2	2.9	4.5	6.1	5.9	2.5
Malawi	1.2	0.8	0.1	3.0	0.8	0.7	0.9	1.1
Namibia	0.5	3.3	7.4	11.0	12.0	11.0	11.4	7.6
Niger	0.0	0.5	1.0	2.1	1.5	3.4	4.0	1.3
Senegal	0.0	2.1	2.2	4.6	7.5	5.9	7.6	3.9
Tanzania	0.0	0.5	2.1	2.7	4.3	2.1	4.4	2.0
Zambia	0.3	0.7	1.5	4.4	7.2	4.6	1.3	2.5
Zimbabwe	2.9	1.9	6.7	11.6	5.5	9.5	17.3	5.9
Near East/North Africa								
Egypt	6.4	11.7	20.7	28.7	32.1	35.7	34.7	24.0
Morocco	6.9	3.8	9.4	10.5	15.4	15.1	16.5	10.9
Turkey	4.7	10.9	19.4	22.5	36.3	41.4	36.7	20.4
Latin America/Caribbean								
Bolivia	0.0	6.0	8.4	9.8	11.5	11.5	0.0	7.9
Colombia	2.1	4.0	7.5	13.4	14.6	17.1	22.6	9.2
Dominican Republic	1.6	3.0	8.8	10.0	12.4	8.1	0.0	7.4
Guatemala	0.9	5.4	8.8	9.9	10.6	12.7	11.2	8.2
Peru	1.8	3.8	7.3	10.5	15.3	15.7	19.6	9.2

Figure 5.1 Percentage of women with BMI < 18.5 by age of the mother, Demographic and Health Surveys 1990-1995

Sub-Saharan Africa



Near East/North Africa



Latin America/Caribbean

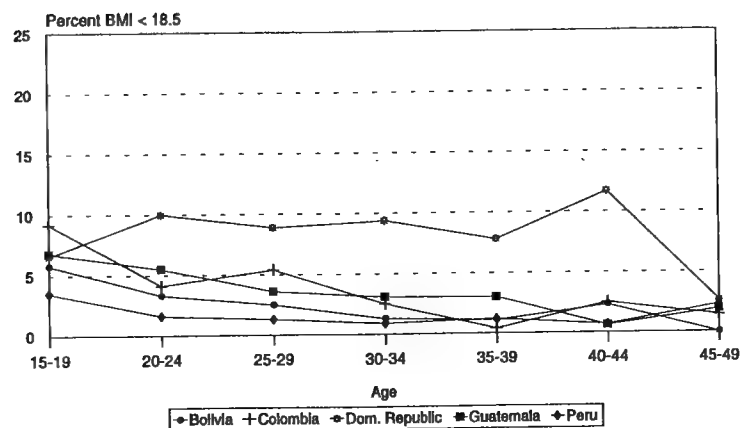


Figure 5.2 Percentage of women with BMI 30+ by age of the mother, Demographic and Health Surveys 1990-1995

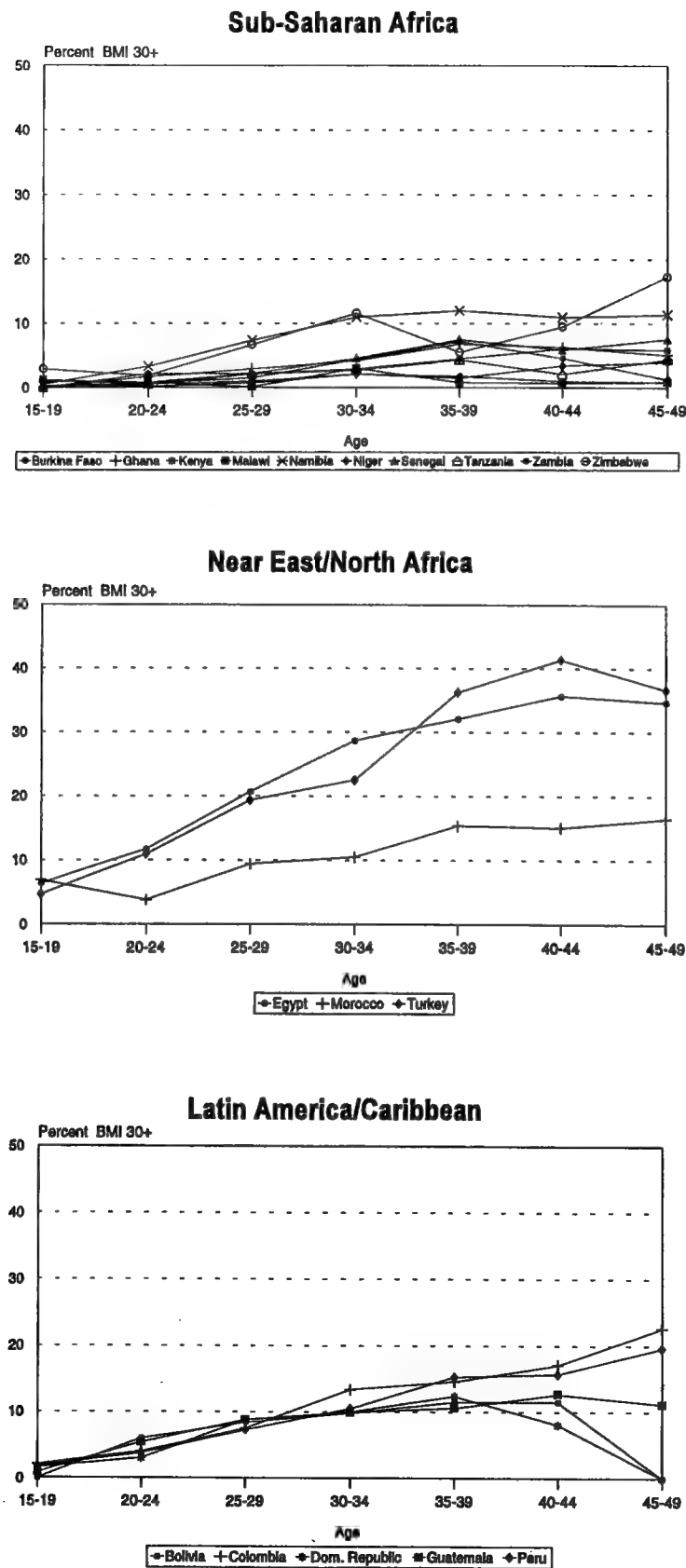


Table 5.2 Mean BMI among women with children under 5 years by parity

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, for parity, Demographic and Health Surveys, 1990-1995

Country and parity of the woman	BMI			Number of cases	Country and parity of the woman	BMI			Number of cases
	Mean	< 18.5	30+			Mean	< 18.5	30+	
Sub-Saharan Africa					Near East/North Africa				
Burkina Faso					Egypt				
1	20.76	15.8	0.1	553	1	25.77	1.8	16.4	679
2 - 3	20.95	14.8	1.2	839	2 - 3	26.75	1.8	23.1	1,593
4 - 5	21.07	12.7	1.0	682	4 - 5	27.34	1.8	27.7	1,094
6 +	21.11	15.4	1.4	938	6 +	27.29	1.0	26.1	1,150
Ghana					Morocco				
1	21.12	15.6	1.5	327	1	23.34	5.0	7.4	418
2 - 3	21.88	10.4	3.7	576	2 - 3	23.88	4.2	9.7	767
4 - 5	21.98	9.4	3.7	383	4 - 5	24.43	3.1	13.0	623
6 +	21.80	15.6	5.1	315	6 +	24.45	3.5	12.2	852
Kenya					Turkey				
1	22.06	6.7	1.1	548	1	24.16	4.5	9.2	607
2 - 3	21.92	8.9	2.0	925	2 - 3	26.14	2.4	19.2	1,050
4 - 5	21.97	10.4	2.0	675	4 - 5	26.94	1.0	26.7	333
6 +	22.03	12.7	4.3	906	6 +	26.84	0.7	27.9	278
Malawi					Latin America/Caribbean				
1	21.25	10.7	1.1	370	Bolivia				
2 - 3	21.55	9.4	0.7	576	1	23.10	4.3	3.3	469
4 - 5	21.37	10.0	1.1	478	2 - 3	24.11	2.6	7.5	714
6 +	21.74	9.2	1.3	684	4 - 5	24.69	1.2	11.7	452
Namibia					6 +	25.13	1.7	9.5	506
1	21.83	15.6	4.2	595	Colombia				
2 - 3	22.69	12.0	7.9	652	1	23.47	4.8	4.9	1,014
4 - 5	23.34	13.1	10.4	388	2 - 3	24.65	3.8	9.3	1,400
6 +	22.79	15.2	9.1	452	4 - 5	25.51	2.3	15.6	456
Niger					6 +	25.51	3.6	13.7	259
1	19.95	25.2	0.2	427	Dominican Republic				
2 - 3	20.45	22.6	0.7	801	1	22.63	9.5	4.2	486
4 - 5	20.76	17.0	1.1	679	2 - 3	23.27	9.5	7.8	911
6 +	21.22	17.0	2.3	1,073	4 - 5	24.10	6.8	12.5	360
Senegal					6 +	23.13	9.1	4.7	236
1	21.13	14.1	1.4	427	Guatemala				
2 - 3	21.26	20.3	2.5	720	1	23.13	5.7	3.6	755
4 - 5	21.67	15.6	1.6	565	2 - 3	24.31	4.7	10.4	1,403
6 +	22.75	11.3	7.3	955	4 - 5	24.59	2.7	9.4	977
Tanzania					6 +	24.44	2.4	7.7	1,401
1	21.56	9.8	0.6	821	Peru				
2 - 3	21.89	7.6	2.4	1,263	1	23.91	2.0	4.6	1,065
4 - 5	21.58	10.0	1.9	841	2 - 3	24.60	1.4	7.6	1,780
6 +	22.70	12.0	2.6	1,190	4 - 5	25.46	0.7	14.1	998
Zambia					6 +	25.42	0.8	12.9	998
1	21.03	14.4	0.3	651					
2 - 3	21.31	12.2	1.0	858					
4 - 5	22.20	9.3	3.5	563					
6 +	22.55	9.6	4.9	898					
Zimbabwe									
1	22.52	5.6	2.5	465					
2 - 3	22.88	5.4	5.3	613					
4 - 5	23.34	5.8	8.5	327					
6 +	23.95	3.4	9.0	383					

Figure 5.3 Percentage of women with BMI < 18.5 by parity, Demographic and Health Surveys 1990-1995

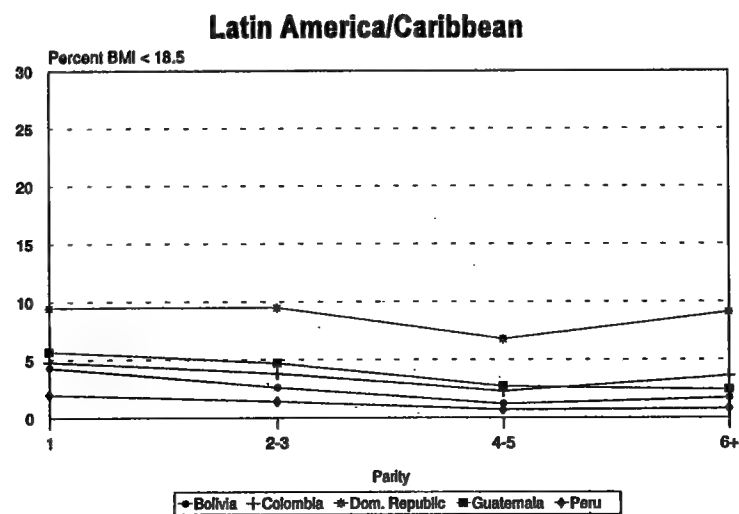
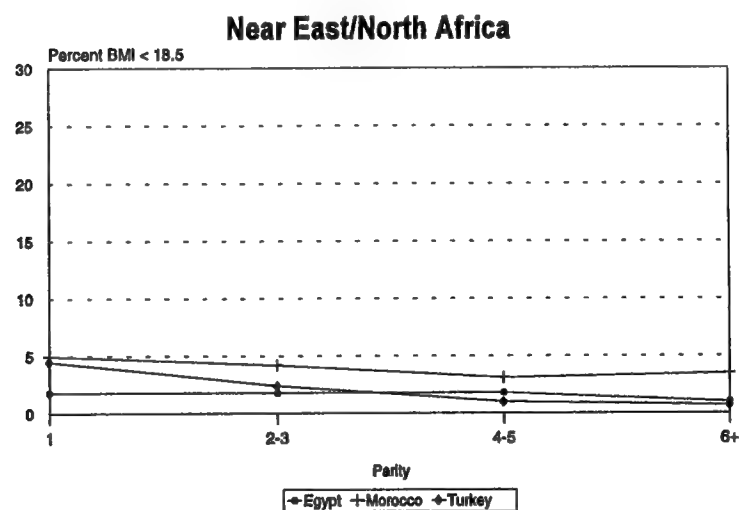
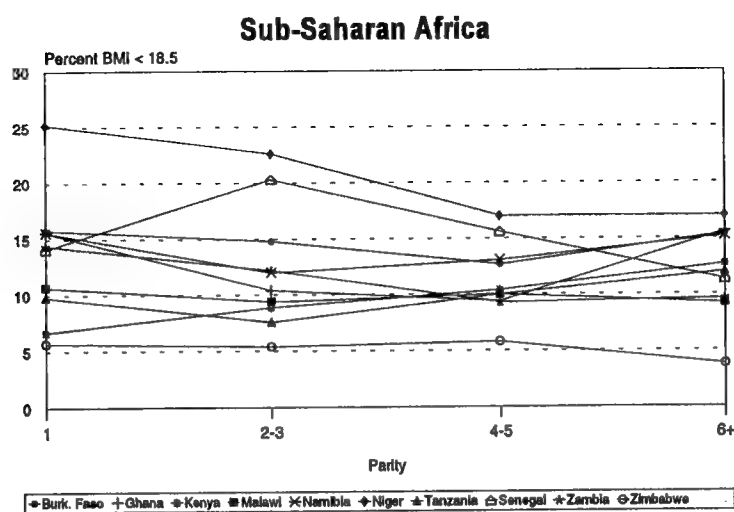


Figure 5.4 Percentage of women with BMI 30+ by parity, Demographic and Health Surveys 1990-1995

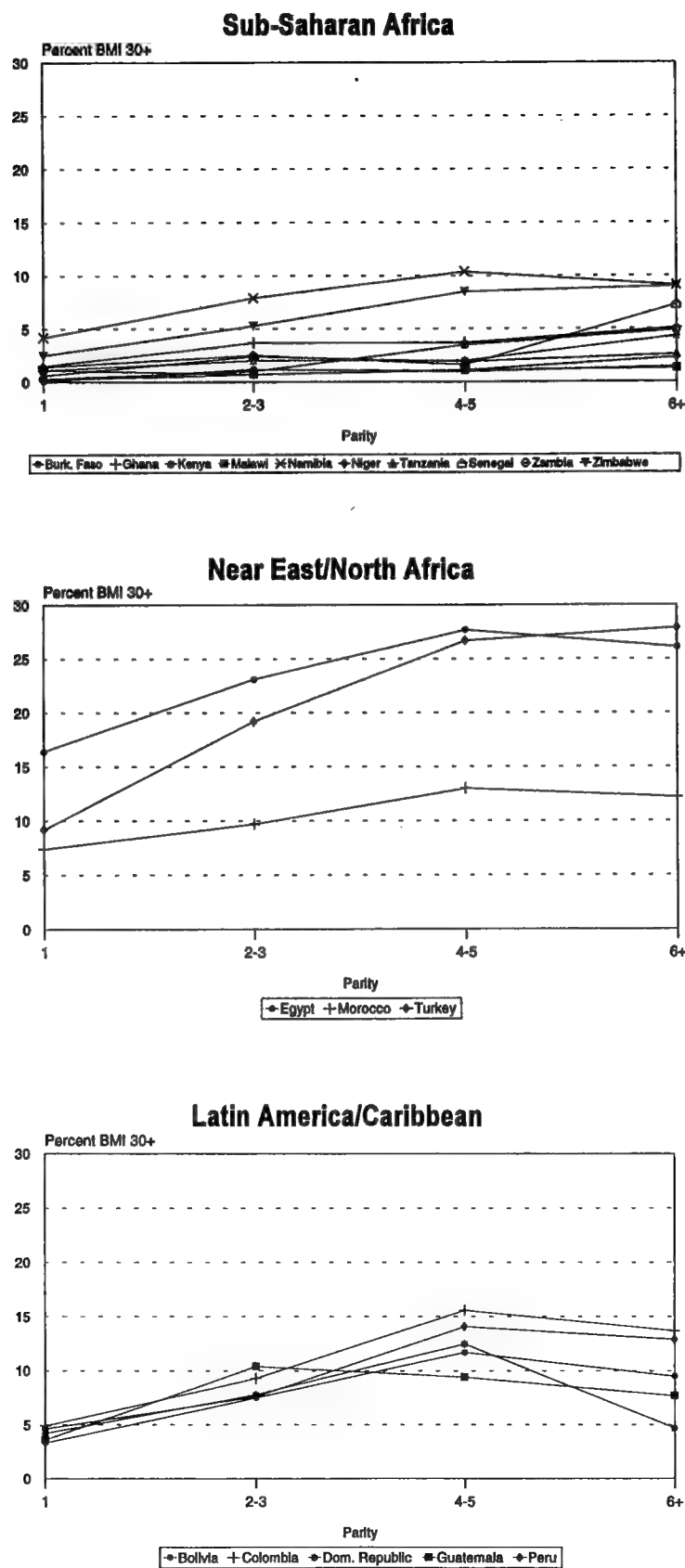


Table 5.3 Mean BMI among women with children under 5 years by last birth interval

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by last birth intervals, Demographic and Health Surveys, 1990-1995

Country and last birth interval	BMI			Number of cases	Country and last birth interval	BMI			Number of cases
	Mean	< 18.5	30+			Mean	< 18.5	30+	
Sub-Saharan Africa					Near East/North Africa				
Burkina Faso					Egypt				
First birth	20.76	15.8	0.1	553	First birth	25.77	1.8	16.4	418
< 24 months	21.16	13.5	1.4	746	< 24 months	26.28	1.9	20.9	956
24 + months	21.00	14.9	1.1	1,706	24 + months	27.74	1.3	28.9	1,286
Ghana					Morocco				
First birth	21.12	15.6	1.5	327	First birth	23.34	5.0	7.4	418
< 24 months	21.58	14.0	3.0	335	< 24 months	23.90	3.1	8.7	956
24 + months	22.00	10.5	4.4	939	24 + months	24.51	4.0	13.7	1,286
Kenya					Turkey				
First birth	22.06	6.7	1.1	548	First birth	24.16	4.5	9.2	607
< 24 months	21.89	11.3	2.7	1,218	< 24 months	25.50	2.8	17.8	647
24 + months	22.05	10.0	3.0	1,288	24 + months	27.02	1.2	25.1	1,014
Malawi					Latin America/Caribbean				
First birth	21.25	10.7	1.1	370	Bolivia				
< 24 months	21.68	8.4	1.3	659	First birth	23.10	4.3	3.3	469
24 + months	21.52	10.1	0.9	1,079	< 24 months	24.39	2.3	7.6	799
Namibia					24 + months	24.73	1.7	10.7	873
First birth	21.83	15.6	4.2	595	Colombia				
< 24 months	22.46	13.8	7.1	552	First birth	23.47	4.8	4.9	1,014
24 + months	23.15	12.8	10.0	940	< 24 months	24.19	4.7	8.5	842
Niger					24 + months	25.43	2.6	13.0	1,273
First birth	19.95	25.2	0.2	427	Dominican Republic				
< 24 months	20.81	19.3	1.5	1,191	First birth	22.63	9.5	4.2	486
24 + months	20.91	18.2	1.5	1,362	< 24 months	23.07	9.4	6.9	804
Senegal					24 + months	23.86	8.3	10.3	703
First birth	21.13	14.1	1.4	427	Guatemala				
< 24 months	22.13	15.1	4.2	866	First birth	23.13	5.8	3.6	755
24 + months	21.92	15.4	3.8	1,374	< 24 months	24.00	3.6	6.8	1,915
Tanzania					24 + months	24.84	3.2	11.6	1,866
First birth	21.56	9.8	0.6	821	Peru				
< 24 months	21.78	9.3	2.5	1,188	First birth	23.91	2.0	4.6	1,065
24 + months	21.72	10.1	2.3	2,106	< 24 months	24.57	1.3	9.0	1,702
Zambia					24 + months	25.39	0.9	11.9	2,074
First birth	21.03	14.3	0.3	651					
< 24 months	22.05	10.1	3.3	942					
24 + months	21.97	10.8	3.0	1,377					
Zimbabwe									
First birth	22.52	5.7	2.5	465					
< 24 months	22.86	4.4	5.2	357					
24 + months	23.45	5.3	7.9	966					

deficiency increases between 3 and 18 months postpartum and then stabilizes or decreases. Some fluctuations are observed by country and region, depending on the length of the period of lactation. In sub-Saharan Africa, where breastfeeding averages about 20 months, the percentage of mothers with chronic energy deficiency (BMI < 18.5) increases with the length of the postpartum period and stabilizes around 10 percent after three years (22 percent in Niger).

The percentage of mothers with BMI 30+ also increases with the length of the postpartum period, with the highest values for mothers who are three or more years postpartum (Table 5.4). In Latin America, for example, between 9 and 15 percent of the mothers with three years since their last birth, are obese compared with 4 to 6 percent among those with only three to six months since the last birth. Clearly, lactation affects the weight of the mother (and her BMI), as will be explained further in the next sections.

Breastfeeding Status

Table 5.5 presents the average BMI and the percentage of mothers below and above the cutoff points for chronic energy deficiency and obesity by breastfeeding status of the mother. Women tend to lose weight during lactation which affects their BMI. Although the mean BMI is lower for lactating mothers, in 7 of the 18 countries analyzed—Burkina Faso, Ghana, Malawi, Niger, Turkey, Bolivia, and Peru—the percentage of mothers with chronic energy deficiency (BMI < 18.5) was actually higher among nonlactating than lactating mothers (see Figure 5.5). At the other end of the distribution, the percentage of obese mothers (BMI 30+) is higher among nonlactating mothers in the all countries except the Dominican Republic, and is especially high in the three Near East/North African countries (see Figure 5.6).

5.2 CHILD HEALTH VARIABLES

One way of looking at the possible outcomes associated with maternal malnutrition is to analyze the relationship between high-risk factors (short stature, chronic energy deficiency, and obesity) and children's health as expressed by birth weight, child anthropometry, and mortality. This can be seen from the perspective of intergenerational links: small maternal size, low birth weight, growth failure in children, leading back to small adults. As shown in the Second Report on the World Nutrition Situation (United Nations, 1992), "...high incidences of low birth weight occur in areas where there is much underweight in women," and "...where there is a high proportion of underweight children, this may lead to higher levels of underweight adults," and showing "...across generations, small mothers having small babies who grow into small mothers again." This frame of analysis can be applied to DHS data, which assesses maternal nutritional status (using anthropometry) at the same time children are measured. However, given that the relationship between maternal chronic energy deficiency and children's health in DHS surveys is based only on information regarding the last child born in the five years before the survey, the results should be considered minimum estimates.

Birth Weight

Mothers of children born in the five years before the survey were asked directly about their children's birth weight. For this analysis, a dichotomous variable was created: children born weighing less than 2.5 kilograms, and children whose birth weight was 2.5 kilograms or more. Children without weight information were included by using the questions on prematurity at birth and the mother's perceived size of the baby at birth. Children were classified as having a birth weight of < 2.5 kg if they were "small" or "very small" at birth or born prematurely with an "average" size at birth. Again, the analysis is restricted to the information about the last child and although the mother's assessment of chronic energy deficiency is done after her child's birth, the relationship is still meaningful. The question of causality between chronic energy deficiency among mothers and the incidence of low birth weight in babies seems to go in both directions in DHS studies.

The percentage of mothers whose children were born with low birth weight (< 2.5 kg) varies across countries from 11 percent in Ghana, Tanzania, Zambia, and Colombia to 32 percent in Senegal. For some of these countries, a large proportion of women did not know their children's birth weight, leaving the present classification based largely on the perceived size of the child at birth. Table 5.6 presents mean values and the percentage of mothers below the cutoff points for height and BMI by birth weight of the last child. Average height is lower for mothers who gave birth to low birth weight children. In Latin American countries, although there are no important differences in mothers' mean height by children's birth weight, the percentage of mothers whose height is below 145 centimeters is much larger among those whose children had low birth weights (< 2.5 kg). In Peru, for example, 23 percent of mothers who gave birth to low birth weight children had a height below 145 centimeters (stunted), compared with 15 percent of mothers whose children weighed 2.5 kg or more at birth.

Similarly, BMIs are lower among mothers whose children were low birth weight (see Figure 5.7). Overall, chronic energy deficiency seems to be more prevalent among mothers whose children were underweight at birth (< 2.5 kg), except in Peru and Morocco, where the percentages are about the same). Birth weight shows the greatest differences in the sub-Saharan countries, particularly in Burkina Faso, Malawi, Namibia, and Niger.

Are children of obese mothers likely to be born with low weight (< 2.5 kg)? The last column under BMI in Table 5.6 shows higher percentages of obese mothers have children with birth weights of 2.5 kg and above in all countries except Malawi and Egypt. The differentials are greatest in the Latin American countries, particularly the Dominican Republic, Guatemala, and Peru (see Figure 5.8).

Child Anthropometry

The anthropometric status of the last-born child, defined in this report by the index height-for-age, is included here as a covariant of mother's malnutrition. The primary objective is to examine levels of malnutrition across generations. This is done by comparing the nutritional status of mothers with that of their most recent child. The height-for-age index is expressed as Z-scores from the median of the International Reference Population (as recommended by the World Health Organization). A Z-score is the number of standard deviation units a child's measurements deviate from the median of the reference population for that age group. A low score in the height-for-age index is evidence of chronic energy deficiency in which past deficiencies resulted in short stature. The extent of children's chronic energy deficiency, as measured by height-for-age, is expressed as the percentage of children whose Z-score falls below -2 SD from the median of the reference population.

Table 5.4 Mean BMI among women with children under 5 years by number of months since last birth

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by number of months since last birth, Demographic and Health Surveys, 1990-1995

Country and months since last birth	BMI			Number of cases	Country and months since last birth	BMI			Number of cases
	Mean	< 18.5	30+			Mean	< 18.5	30+	
Sub-Saharan Africa					Near East/North Africa				
Burkina Faso					Egypt				
3 - 6 months	21.16	12.7	0.8	323	3 - 6 months	26.08	1.7	16.4	407
6 -11 months	20.93	12.2	0.5	425	6 -11 months	25.58	2.3	14.6	572
12-17 months	20.80	13.4	0.9	478	2-17 months	25.76	2.3	18.4	550
18-23 months	21.04	15.1	1.0	324	18-23 months	26.20	1.9	19.4	461
24-35 months	20.91	16.1	0.8	547	24-35 months	27.26	1.1	27.2	834
36 + months	21.26	16.5	2.0	579	36 + months	28.57	1.3	34.4	1,254
Ghana					Morocco				
3 - 6 months	22.04	11.0	4.1	218	3 - 6 months	24.02	1.0	9.2	206
6 -11 months	21.91	8.1	3.3	299	6 -11 months	23.44	5.1	6.8	415
12-17 months	21.60	15.5	3.0	263	12-17 months	23.16	5.7	7.3	368
18-23 months	21.52	14.6	3.1	226	18-23 months	23.90	3.8	10.0	291
24-35 months	21.56	13.9	3.5	396	24-35 months	24.19	3.0	11.3	434
36 + months	U	U	U	U	36 + months	25.29	3.2	17.0	648
Kenya					Turkey				
3 - 6 months	22.01	8.0	2.3	287	3 - 6 months	25.39	1.8	14.2	201
6 -11 months	21.61	11.8	1.1	493	6 -11 months	24.91	2.4	14.2	290
12-17 months	21.87	12.3	1.7	399	12-17 months	24.95	2.1	15.1	234
18-23 months	21.73	9.8	3.0	349	18-23 months	25.54	3.7	16.8	213
24-35 months	21.65	10.5	1.4	496	24-35 months	25.84	1.8	20.0	383
36 + months	22.85	7.2	5.3	659	36 months	26.80	3.1	24.0	718
Malawi					Latin America/Caribbean				
3 - 6 months	21.60	5.6	0.6	266	Bolivia				
6 -11 months	21.68	8.5	1.1	397	3 - 6 months	24.38	3.0	6.2	299
12-17 months	21.29	11.1	1.2	294	6 -11 months	23.95	2.4	8.5	455
18-23 months	21.49	10.6	0.8	237	12-17 months	23.80	3.3	7.1	366
24-35 months	21.49	10.6	2.6	305	18-23 months	24.15	1.7	6.8	262
36 + months	21.27	12.7	0.3	337	24-35 months	24.83	2.1	8.7	448
Namibia					36 + months	U	U	U	U
3 - 6 months	22.51	11.3	4.7	233	Colombia				
6 -11 months	22.06	13.3	3.8	321	3 - 6 months	24.23	5.8	6.3	238
12-17 months	21.91	21.1	7.0	321	6 -11 months	23.88	6.4	6.6	388
18-23 months	22.41	17.1	6.9	220	12-17 months	24.07	3.2	8.0	363
24-35 months	23.04	10.2	8.9	372	18-23 months	23.77	4.9	7.6	339
36 + months	23.68	11.7	12.6	366	24-35 months	24.79	2.6	10.5	565
Niger					36 + months	25.01	2.9	11.5	944
3 - 6 months	21.05	13.4	1.1	362	Dominican Republic				
6 -11 months	20.90	19.2	1.7	535	3 - 6 months	23.30	4.5	4.0	172
12-17 months	20.39	22.1	0.6	455	6 -11 months	22.52	8.9	3.5	350
18-23 months	20.71	19.5	2.1	328	12-17 months	23.24	9.6	7.3	255
24-35 months	20.36	22.1	1.0	468	18-23 months	22.40	14.1	5.3	213
36 + months	21.01	22.4	2.0	421	24-35 months	23.78	5.8	8.5	319
Senegal					36 + months	24.03	9.0	13.2	492
3 - 6 months	21.72	13.7	2.7	336	Guatemala				
6 -11 months	21.93	13.7	4.1	437	3 - 6 months	23.66	5.0	4.7	481
12-17 months	21.54	15.3	2.7	446	6 -11 months	23.70	4.3	5.3	839
18-23 months	21.17	17.5	2.9	280	12-17 months	23.70	5.0	7.2	710
24-35 months	22.11	16.6	4.3	423	18-23 months	24.00	3.5	7.9	454
36 + months	22.60	13.7	6.8	453	24-35 months	24.42	4.8	8.8	668
Tanzania					36 + months	25.48	1.8	14.7	856
3 - 6 months	22.13	8.4	1.5	429	Peru				
6 -11 months	21.63	10.1	0.5	695	3 - 6 months	24.44	0.9	4.4	492
12-17 months	21.41	10.1	1.9	651	6 -11 months	24.36	1.4	8.6	703
18-23 months	21.51	8.9	1.3	558	12-17 months	23.95	1.4	5.9	568
24-35 months	21.54	12.6	1.4	626	18-23 months	24.21	1.7	6.5	454
36 + months	22.19	9.0	4.5	677	24-35 months	24.93	1.4	9.6	828
Zambia					36 + months	25.69	1.1	13.9	1,324
3 - 6 months	21.95	7.8	2.4	366					
6 -11 months	21.68	11.4	2.4	546					
12-17 months	21.50	13.5	2.6	458					
18-23 months	21.59	12.5	1.4	352					
24-35 months	22.04	10.9	2.9	453					
36 + months	22.10	11.9	2.9	418					
Zimbabwe									
3 - 6 months	22.97	5.4	2.7	205					
6 -11 months	22.83	4.4	4.8	337					
12-17 months	22.78	9.1	7.1	256					
18-23 months	22.95	5.5	5.3	268					
24-35 months	23.73	2.4	8.5	461					
36 + months	U	U	U	U					

U = Unknown (not available)

Table 5.5 Mean BMI among women with children under 5 years by breastfeeding status

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by breastfeeding status, Demographic and Health Surveys, 1990-1995

Country and breastfeeding status	BMI			Number of cases
	Mean	< 18.5	30+	
Sub-Saharan Africa				
Burkina Faso				
No	21.34	15.6	1.7	1,017
Yes	20.86	14.3	0.7	1,995
Ghana				
No	22.30	12.3	5.8	487
Yes	21.48	12.2	2.5	1,114
Kenya				
No	22.35	7.7	3.4	1,303
Yes	21.72	11.5	1.9	1,751
Malawi				
No	21.48	11.3	1.6	799
Yes	21.55	8.7	0.7	1,309
Namibia				
No	23.32	11.3	10.7	1,087
Yes	21.73	16.9	3.8	1,000
Niger				
No	20.83	21.3	1.7	1,065
Yes	20.69	18.8	1.2	1,915
Senegal				
No	22.23	14.9	5.0	1,081
Yes	21.60	15.2	3.1	1,586
Tanzania				
No	21.91	9.6	3.1	1,530
Yes	21.58	10.0	1.3	2,585
Zambia				
No	22.02	10.8	2.6	1,215
Yes	21.62	22.7	2.4	1,755
Zimbabwe				
No	23.49	2.8	6.7	754
Yes	22.80	7.1	5.4	1,034
Near East/North Africa				
Egypt				
No	27.89	1.2	30.5	2,562
Yes	25.60	2.1	15.7	1,953
Morocco				
No	24.74	3.2	14.2	1,698
Yes	22.98	5.0	5.1	962
Turkey				
No	26.08	3.1	20.4	1,643
Yes	25.14	1.2	14.4	625
Latin America/Caribbean				
Bolivia				
No	24.46	2.9	9.5	808
Yes	24.11	2.2	6.9	1,303
Colombia				
No	24.52	3.5	9.6	2,202
Yes	24.34	4.6	8.1	927
Dominican Republic				
No	23.45	8.9	8.3	1,517
Yes	22.44	9.5	4.0	476
Guatemala				
No	25.12	3.0	13.0	1,618
Yes	23.54	4.4	4.9	2,918
Peru				
No	25.12	1.5	11.4	2,690
Yes	24.30	1.1	6.4	2,151

A comparison of mother's nutritional status with last child's anthropometric status is shown in Table 5.7 and Figure 5.9 by age of the child (< 24 months and 24+ months). In Latin America, the percentage of mothers who are stunted (< 145 cm) shows marked differentials by children's anthropometric status. The highest percentages are among mothers with stunted children (below -2 SD) in Bolivia, Colombia, Guatemala, and Peru. Within this group, mothers of younger children (less than two years) have the highest percentages of stunting. The fact that this pattern is only observed in Latin American countries may be due to the presence of higher proportions of indigenous populations—typically shorter and heavier—in these countries.

When weight is controlled for, the relationship changes considerably. The percentage of mothers with chronic energy deficiency is highest among those with stunted children (below -2 SD), particularly in the sub-Saharan countries (see Figure 5.9). In Namibia, for example, 23 percent of mothers of stunted children have chronic energy deficiency (BMI < 18.5) compared with 13 percent of mothers whose children have normal height-for-age scores.

The differences in stunting, noted earlier for Latin America do not translate into higher percentages of chronic energy deficiency among mothers. The only exception is the Dominican Republic, where chronic energy deficiency is much higher for mothers of stunted children. In the Near East and North Africa, chronic energy deficiency is higher among mothers of children with normal height-for-age (see also Figure 5.10).

Mortality

This section examines the relationship between mother's malnutrition and child survival. The child survival variable identifies those mothers who experienced the death of a child born during the five years preceding the survey. The results are mixed and do not allow identification of any specific patterns across countries or regions (see Table 5.8). For six countries (Ghana, Tanzania, Zimbabwe, Turkey, Bolivia, and Colombia) the mean BMI is slightly higher among mothers with a dead child than those without. For the remaining 12 countries, the mean BMIs are either greater among women who did not experience the death of a child or are very similar.

There are eight countries (Malawi, Niger, Tanzania, Zimbabwe, Morocco, Turkey, Bolivia, and Colombia) that have a higher percentage of chronic energy deficiency among mothers with all their children surviving than among those with a dead child. Only in Ghana, Kenya, the Dominican Republic, and Guatemala are chronic energy deficiency percentages higher for mothers who had a child die than for those who have all their children surviving. In the rest of the countries, the percentage differences are small, indicating no relationship.

As with chronic energy deficiency, the percentage of obese women by child survival status varies from country to country. In Egypt, Morocco, Bolivia, and Colombia, mothers who did not experience a child death have higher percentages of obesity, while in Turkey, the Dominican Republic, and Guatemala, the opposite is found.

Figure 5.5 Percentage of women with chronic energy deficiency (BMI < 18.5) by breastfeeding status, Demographic and Health Surveys 1990-1995

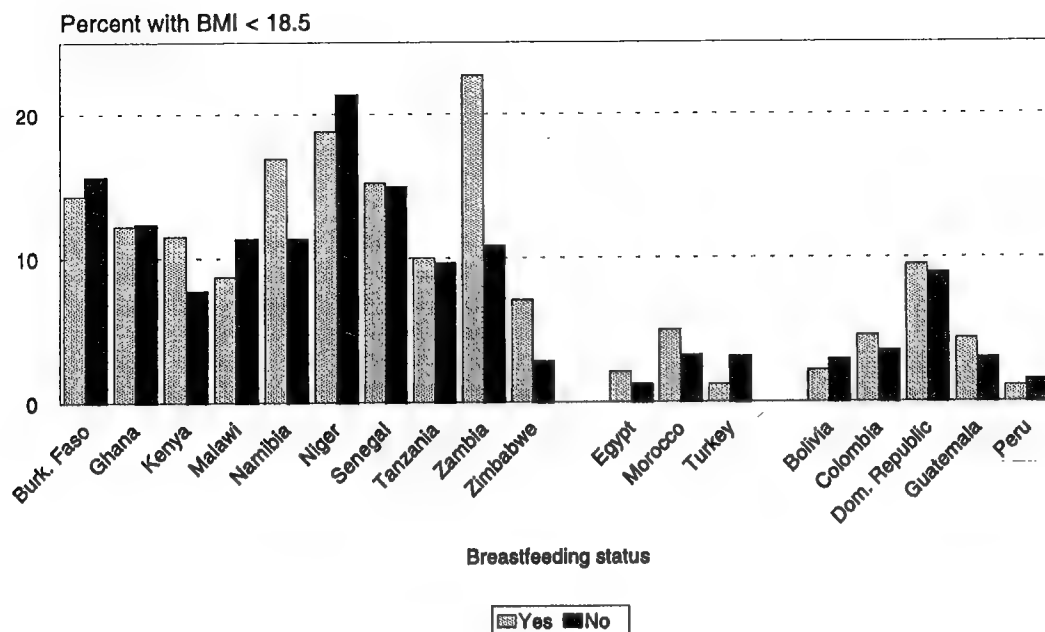


Figure 5.6 Percentage of obese women (BMI 30+) by breastfeeding status, Demographic and Health Surveys 1990-1995

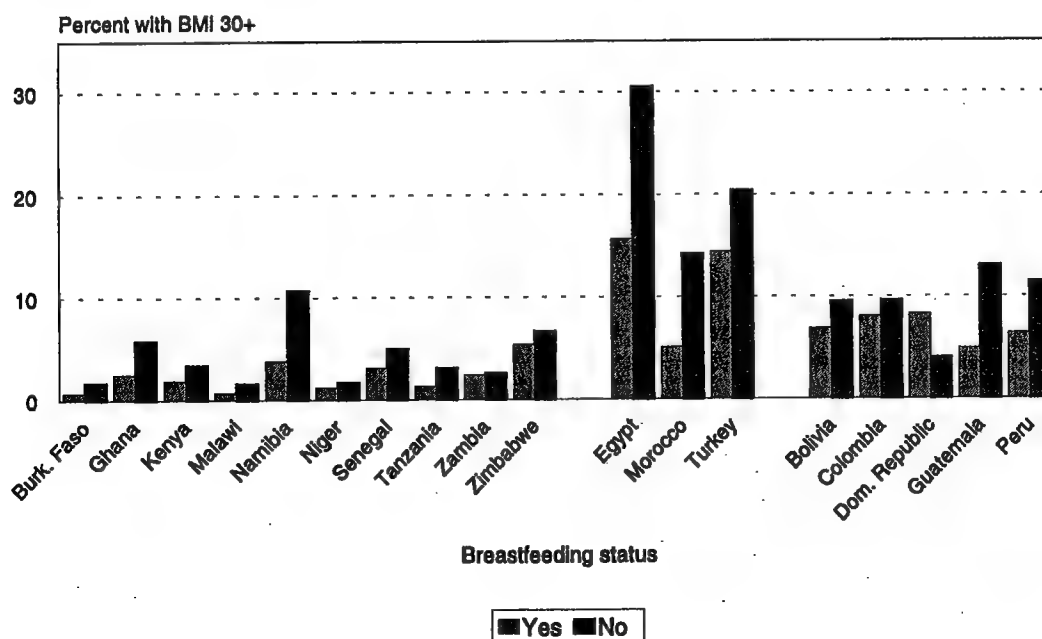


Table 5.6 Mean height and BMI among women with children under 5 years by birth weight of last child

Mean height and BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for height and BMI, by birth weight of last child, Demographic and Health Surveys, 1990-1995

Country and last child birth weight	Height (cm)		BMI			Number of cases
	Mean	< 145	Mean	< 18.5	30+	
Sub-Saharan Africa						
Burkina Faso						
2.5+ kg	161.70	0.1	21.15	13.3	1.2	2,392
< 2.5 kg	161.05	0.8	20.49	19.5	0.3	620
Ghana						
2.5+ kg	158.45	1.2	21.80	11.6	3.7	1,418
< 2.5 kg	158.86	1.1	21.20	16.9	2.2	183
Kenya						
2.5+ kg	159.33	8.3	22.06	9.7	2.7	2,640
< 2.5 kg	157.97	11.8	21.56	11.2	1.6	414
Malawi						
2.5+ kg	156.27	2.6	21.58	8.7	1.0	1,760
< 2.5 kg	155.17	4.5	21.24	14.3	1.5	348
Namibia						
2.5+ kg	160.79	1.0	22.77	12.9	8.2	1,725
< 2.5 kg	159.41	2.5	21.72	18.8	4.4	362
Niger						
2.5+ kg	160.60	0.3	20.98	17.8	1.7	2,094
< 2.5 kg	159.76	0.7	20.28	23.1	0.6	886
Senegal						
2.5+ kg	162.37	0.2	22.11	13.5	4.7	1,826
< 2.5 kg	162.44	0.0	21.31	18.5	2.1	841
Tanzania						
2.5+ kg	155.95	3.5	21.75	9.7	2.0	3,673
< 2.5 kg	155.08	4.7	21.32	11.2	2.0	442
Zambia						
2.5+ kg	158.06	1.2	21.85	10.9	2.7	2,658
< 2.5 kg	158.00	1.3	21.19	15.2	0.7	312
Zimbabwe						
2.5+ kg	159.45	0.7	23.12	5.1	6.1	1,517
< 2.5 kg	158.34	1.5	22.95	5.9	5.1	271
Near East/North Africa ¹						
Egypt						
2.5+ kg	157.15	1.0	26.92	1.5	23.9	3,833
< 2.5 kg	156.44	2.5	26.70	2.2	24.4	683
Morocco						
2.5+ kg	157.06	1.2	24.27	3.9	11.5	2,043
< 2.5 kg	156.89	1.1	23.58	3.7	8.4	617
Latin America/Caribbean						
Bolivia						
2.5+ kg	151.24	12.5	24.31	2.3	8.5	1,804
< 2.5 kg	149.94	14.2	23.92	3.5	4.9	337
Colombia						
2.5+ kg	154.69	5.3	24.53	3.5	9.5	2,792
< 2.5 kg	152.98	10.4	23.95	6.6	6.4	337
Dominican Republic						
2.5+ kg	156.48	1.6	23.43	8.3	8.0	1,745
< 2.5 kg	155.66	4.6	21.90	14.0	3.0	248
Guatemala						
2.5+ kg	148.46	30.0	24.35	3.8	8.9	3,645
< 2.5 kg	147.16	36.1	23.50	4.0	5.4	891
Peru						
2.5+ kg	150.50	15.2	24.83	1.3	9.6	4,136
< 2.5 kg	149.36	23.1	24.36	1.2	6.4	705

¹ Question not asked in the 1993 DHS survey in Turkey.

Figure 5.7 Percentage of women with chronic energy deficiency (BMI < 18.5) by birth weight of last child, Demographic and Health Surveys 1990-1995

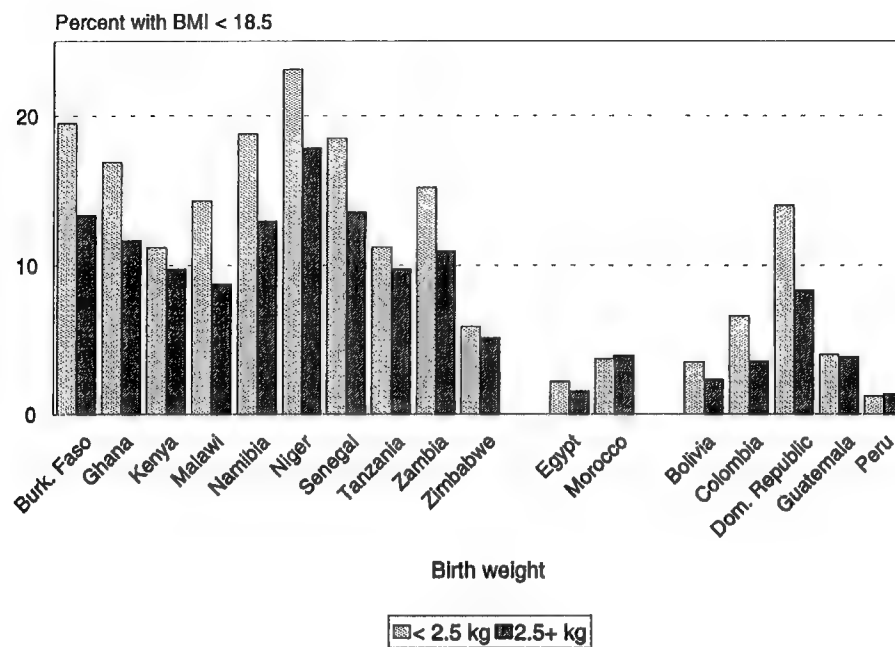


Figure 5.8 Percentage of obese women (BMI 30+) by birth weight of last child, Demographic and Health Surveys 1990-1995

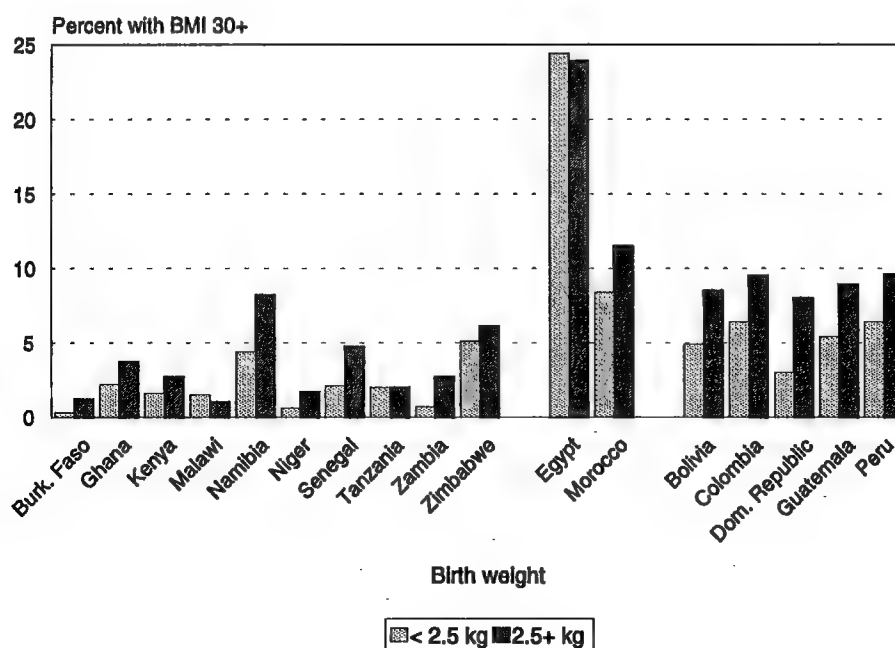


Table 5.7 Mean height and BMI among women with children under 5 years by last child anthropometry and age

Mean height and BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for height and BMI, by last child anthropometry (height-for-age) and age, Demographic and Health Surveys, 1990-1995

Country and last child anthropometry and age	Height		BMI			Number of cases	Country and last child anthropometry and age	Height		BMI			Number of cases
	Mean	< 145	Mean	< 18.5	30+			Mean	< 145	Mean	< 18.5	30+	
Sub-Saharan Africa							Near East/North Africa						
Burkina Faso							Egypt						
% above -2 SD	162.22	0.2	21.21	11.7	1.1	1,734	% above -2 SD	157.37	1.0	27.31	1.6	26.6	3,160
< 24 months	162.11	0.2	21.11	12.0	0.8	1,178	< 24 months	157.16	1.1	26.05	2.1	18.1	1,606
24 + months	162.50	0.0	21.46	10.9	1.8	556	24 + months	157.59	1.0	28.62	1.0	35.4	1,554
% below -2 SD	160.15	0.6	20.48	20.1	0.4	656	% below -2 SD	155.88	2.0	25.78	1.9	17.9	992
< 24 months	160.37	0.7	20.42	18.2	0.8	356	< 24 months	156.10	2.6	25.35	2.1	15.5	538
24 + months	159.88	0.5	20.54	22.4	0.0	300	24 + months	155.59	1.2	26.31	1.7	20.8	454
Ghana							Morocco						
% above -2 SD	158.93	0.7	21.93	10.6	3.7	1,067	% above -2 SD	157.52	0.6	24.39	3.5	12.1	1,897
< 24 months	158.88	0.7	21.89	10.3	3.5	828	< 24 months	157.08	0.6	23.70	4.1	8.2	1,116
24 + months	159.13	0.4	22.08	11.7	4.2	239	24 + months	157.68	0.5	25.37	2.6	17.7	781
% below -2 SD	157.18	2.0	21.01	15.0	1.7	354	% below -2 SD	155.28	3.0	23.06	4.7	6.9	533
< 24 months	156.90	1.3	21.11	15.6	1.8	224	< 24 months	155.17	3.4	22.70	5.6	6.4	267
24 + months	157.65	3.1	20.84	13.9	1.5	130	24 + months	155.39	2.6	23.42	3.8	7.5	266
Kenya							Turkey						
% above -2 SD	160.01	0.5	22.21	8.5	3.2	1,856	% above -2 SD	155.74	2.0	25.92	2.4	19.5	1,741
< 24 months	160.09	0.4	22.88	9.8	2.1	1,176	< 24 months	155.68	2.1	25.34	2.7	15.9	913
24 + months	159.89	0.6	22.76	6.2	5.0	680	24 + months	155.81	1.8	26.55	2.0	23.5	828
% below -2 SD	157.29	1.8	21.46	12.3	0.9	784	% below -2 SD	153.36	4.6	25.34	3.6	15.7	319
< 24 months	157.71	2.2	21.43	13.6	0.7	448	< 24 months	153.45	2.9	24.68	0.8	12.8	114
24 + months	156.71	1.5	21.49	10.5	1.3	336	24 + months	153.30	5.6	25.73	5.3	17.4	205
Malawi							Latin America/Caribbean						
% above -2 SD	156.86	2.5	21.70	7.9	1.4	1,016	Bolivia						
< 24 months	156.71	2.8	21.78	6.4	1.3	791	% above -2 SD	151.72	10.2	24.32	2.3	8.9	1,451
24 + months	157.42	1.2	21.39	13.6	2.0	225	< 24 months	151.58	10.6	24.16	2.5	8.6	1,113
% below -2 SD	155.01	3.3	21.26	12.0	0.5	689	24 + months	152.17	9.1	24.83	1.7	9.9	338
< 24 months	155.17	3.2	21.22	12.5	0.1	409	% below -2 SD	149.06	20.2	24.02	2.6	4.6	491
24 + months	154.78	3.4	21.32	11.3	1.0	280	< 24 months	148.96	20.1	23.73	2.4	3.5	361
Namibia							24 + months	149.34	20.5	24.80	3.4	7.9	130
% above -2 SD	161.33	1.0	22.93	12.5	8.7	1,094	Colombia						
< 24 months	161.17	1.0	22.60	12.6	6.8	742	% above -2 SD	155.04	3.8	24.55	3.7	9.8	2,595
24 + months	161.67	0.9	23.63	12.3	12.5	352	< 24 months	155.01	4.1	24.11	4.6	7.8	1,302
% below -2 SD	158.35	1.8	21.17	23.2	3.4	461	24 + months	155.07	3.5	25.00	2.8	11.8	1,293
< 24 months	158.32	1.9	20.89	25.6	2.8	315	% below -2 SD	150.55	19.9	23.95	4.8	6.3	351
24 + months	158.42	1.5	21.79	17.9	4.6	146	< 24 months	149.69	25.6	23.64	6.1	4.7	163
Niger							24 + months	151.32	14.8	24.23	3.8	7.7	188
% above -2 SD	161.27	0.0	21.12	16.1	2.0	1,427	Dominican Republic						
< 24 months	161.07	0.1	21.07	16.2	1.6	1,112	% above -2 SD	156.69	1.5	23.46	8.3	8.4	1,422
24 + months	162.11	0.0	21.37	15.5	3.6	315	< 24 months	156.86	1.8	23.00	8.5	5.6	793
% below -2 SD	159.43	0.8	20.41	21.6	0.7	727	24 + months	156.50	1.0	24.00	8.1	11.9	629
< 24 months	159.19	0.6	20.41	20.8	0.4	461	Guatemala						
24 + months	159.85	0.9	20.41	23.1	1.1	266	% above -2 SD	150.20	20.3	24.64	3.7	10.5	2,162
Senegal							< 24 months	149.25	24.4	23.99	4.1	7.0	1,485
% above -2 SD	162.73	0.1	22.18	13.5	4.9	1,617	24 + months	151.97	12.7	25.86	3.0	16.9	677
< 24 months	162.56	0.1	21.78	14.5	3.7	1,183	% below -2 SD	145.62	45.5	23.41	4.3	4.4	2,010
24 + months	163.20	0.2	23.26	10.6	8.1	434	< 24 months	145.42	48.2	23.18	4.8	3.5	1,226
% below -2 SD	160.88	0.4	21.12	19.8	1.7	475	24 + months	145.94	41.3	23.76	3.6	5.7	784
< 24 months	161.20	0.7	21.21	18.3	2.2	274	Peru						
24 + months	160.44	0.0	21.00	21.9	1.0	201	% above -2 SD	151.22	11.6	24.93	1.1	10.5	3,258
Tanzania							< 24 months	150.81	13.3	24.36	1.1	7.7	1,850
% above -2 SD	156.98	2.0	21.96	7.8	2.0	2,000	24 + months	151.72	9.5	25.64	1.0	13.8	1,408
< 24 months	156.90	2.2	21.87	7.8	1.7	1,478	% below -2 SD	147.74	30.3	24.20	2.1	5.3	1,171
24 + months	157.20	1.3	22.22	7.7	3.1	522	< 24 months	147.57	32.1	23.66	1.8	2.3	548
% below -2 SD	154.45	5.8	21.15	13.5	1.2	1,422	24 + months	147.89	28.5	24.66	2.3	8.0	623
< 24 months	154.28	6.9	21.14	12.4	1.0	906	Zambia						
24 + months	154.74	3.8	21.18	15.6	1.6	516	% above -2 SD	159.77	0.6	22.22	5.0	6.4	1,232
Zimbabwe							< 24 months	159.73	0.6	23.03	5.8	5.5	932
% above -2 SD	159.12	0.5	22.08	10.1	3.2	1,576	24 + months	159.91	0.5	23.84	2.4	9.0	300
< 24 months	158.95	0.7	21.98	9.8	3.0	1,215	% below -2 SD	157.41	2.3	22.47	8.3	5.7	364
24 + months	159.71	0.0	22.43	11.1	3.9	361	< 24 months	157.23	2.1	22.16	11.3	4.7	237
% below -2 SD	156.19	2.2	21.39	14.1	1.5	977	24 + months	157.72	2.4	23.02	3.0	7.4	127
< 24 months	156.03	2.4	21.20	15.2	1.4	599							
24 + months	158.45	2.1	21.69	12.4	1.7	378							

Figure 5.9 Percentage of women with chronic energy deficiency (BMI < 18.5) by last child's anthropometric status, Demographic and Health Surveys 1990-1995

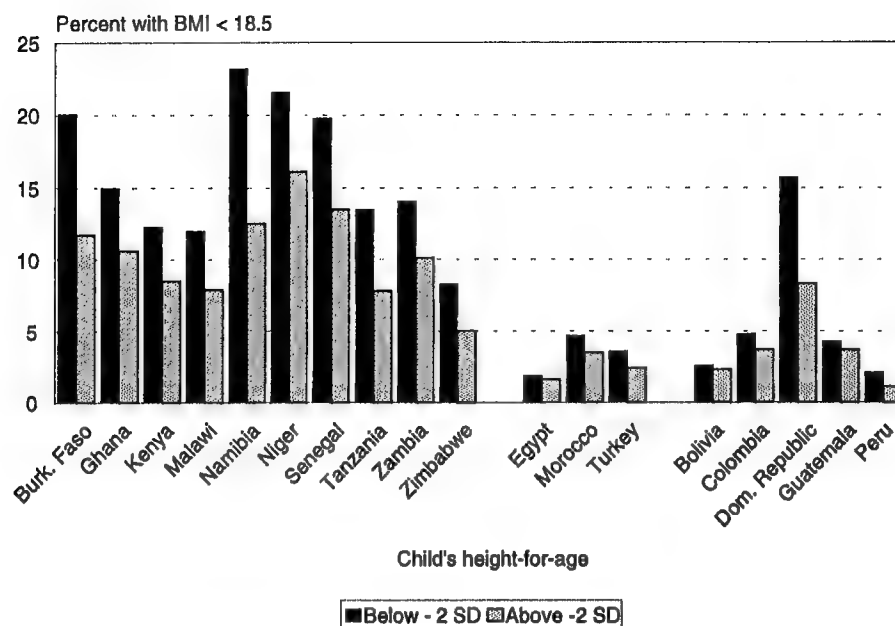
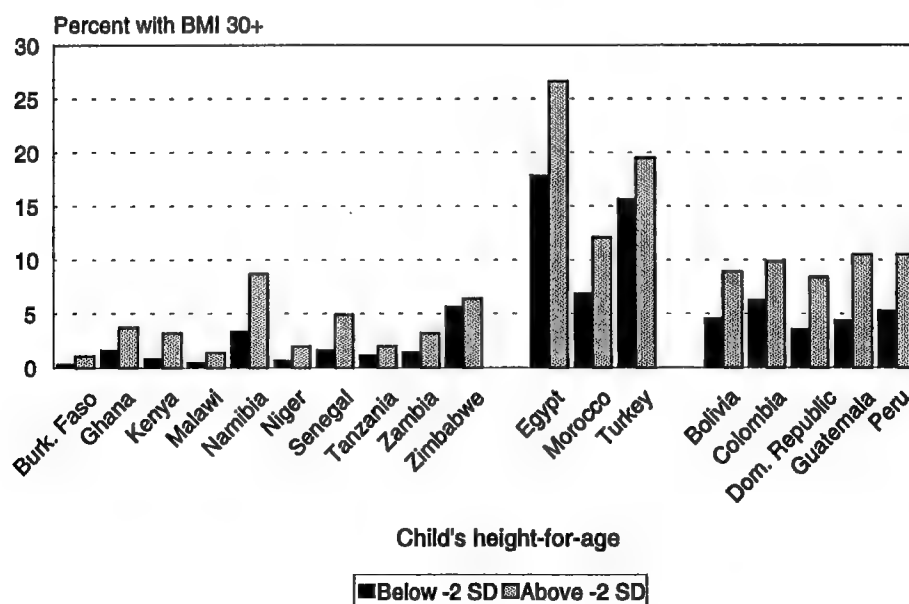


Figure 5.10 Percentage of obese women (BMI 30+) by last child's anthropometric status, Demographic and Health Surveys 1990-1995



**Table 5.8 Mean BMI among women with children under 5 years
by under-five mortality status**

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by under-five mortality status, Demographic and Health Surveys, 1990-1995

Country and under-5 mortality status	BMI			Number of cases
	Mean	< 18.5	30+	
Sub-Saharan Africa				
Burkina Faso				
Dead	20.99	15.2	1.3	582
Living	21.00	14.5	0.9	2,439
Ghana				
Dead	22.80	15.2	4.2	217
Living	21.69	11.8	3.4	1,384
Kenya				
Dead	21.66	11.0	1.4	335
Living	22.04	9.7	2.7	2,719
Malawi				
Dead	21.43	8.6	0.8	538
Living	21.55	10.0	1.1	1,570
Namibia				
Dead	22.20	13.4	7.8	195
Living	22.63	13.9	7.5	1,892
Niger				
Dead	20.63	18.6	0.8	796
Living	20.78	20.1	1.6	2,184
Senegal				
Dead	21.65	15.9	2.4	410
Living	21.90	14.9	3.9	2,257
Tanzania				
Dead	21.98	8.8	2.4	702
Living	21.65	10.0	1.9	3,413
Zambia				
Dead	21.67	11.4	2.1	618
Living	21.81	11.4	2.6	2,352
Zimbabwe				
Dead	23.22	1.8	6.1	169
Living	23.08	5.6	5.9	1,619
Near East/North Africa				
Egypt				
Dead	26.50	1.6	22.5	458
Living	26.92	1.6	24.1	4,058
Morocco				
Dead	23.69	3.4	8.4	238
Living	24.15	3.9	11.2	2,422
Turkey				
Dead	26.28	0.8	26.5	155
Living	25.77	2.7	18.1	2,113
Latin America/Caribbean				
Bolivia				
Dead	24.49	2.3	9.8	254
Living	24.21	2.5	7.7	1,887
Colombia				
Dead	24.61	1.8	10.1	118
Living	24.46	3.9	9.1	3,011
Dominican Republic				
Dead	22.78	10.5	6.3	143
Living	23.27	8.9	7.5	1,850
Guatemala				
Dead	24.03	5.8	7.3	400
Living	24.20	3.7	8.3	4,136
Peru				
Dead	24.72	1.1	9.0	469
Living	24.76	1.3	9.2	4,372

Note: Under-5 mortality status refers to deaths among children born in the 5-year period preceding the survey.

6 Socioeconomic Differentials

6.1 URBAN-RURAL RESIDENCE

The classification of urban and rural places of residence is based on definitions used by the national statistical office in each country. Therefore, the size of towns and cities defined as urban may vary from one country to another.

There are consistent marked differences in the level of malnutrition between urban and rural areas: chronic energy deficiency (CED) is more common in rural areas in all DHS countries except Bolivia and Turkey (see Figure 6.1), while obesity (Figure 6.2) is predominantly an urban manifestation (see Table 6.1).

Chronic energy deficiency is particularly high in the rural areas of the sub-Saharan countries, especially in Burkina Faso, Namibia, Niger, and Senegal, where more than 15 percent of rural mothers have BMI < 18.5. In contrast, in Latin America (but not the Dominican Republic), Egypt, Morocco, and Turkey, chronic energy deficiency is relatively low and/or only small differences exist between urban and rural areas. The opposite is observed regarding obesity: 15 percent or more of urban mothers in the Near East and North African countries present BMI 30+, while in the other two regions, only Namibia, Zimbabwe, Guatemala, and Peru show high percentages of obesity (more than 10 percent) among urban mothers (see Figure 6.2).

6.2 MOTHER'S EDUCATION

Mother's education is defined here as the highest level of schooling attended, regardless of whether the woman completed the level. Thus, women identified as having primary education have attended, but not necessarily completed, primary school. Secondary and higher education have been combined into one category because few women have achieved higher levels of education in most countries.

There is a negative association between mothers' education and chronic energy deficiency—the higher the level of education, the lower the percentage of mothers with BMI below 18.5 (see Table 6.2). This pattern is found in all the DHS sub-Saharan countries, the Dominican Republic, Egypt, and Morocco. In the remaining Latin American countries and Turkey, the pattern is reversed; that is, women with higher levels of education tend to have higher levels of chronic energy deficiency. As will be seen later, the effect of education on chronic energy deficiency, after controlling for other variables, is important only in Kenya, Malawi, Namibia, and Zimbabwe. The multivariate analysis presented in this report also shows lower levels of chronic energy deficiency at higher levels of education.

At the other end of the distribution, obesity tends to increase with education, except in Colombia and Turkey, where the prevalence of obesity is highest among mothers with no education (13 and 21 percent, respectively). By contrast, in Egypt and Guatemala the prevalence of obesity is highest among mothers who attended secondary or higher education (30 and 13 percent, respectively).

6.3 SOCIOECONOMIC STATUS

The socioeconomic status of women with children born in the five years preceding the survey was determined from variables related to household possessions and dwelling characteristics: possession of a radio, television, or refrigerator; floor material, water supply, toilet availability; and the number of persons per sleeping room in the household.⁵

The relationship between socioeconomic status and chronic energy deficiency is more conclusive than that observed for level of education. The higher the level of socioeconomic status, the lower the percentage of mothers with chronic energy deficiency (see Table 6.3). The only exception to this pattern is Bolivia⁶ where the percentage of women with chronic energy deficiency increases with socioeconomic status. Note, however, that in Bolivia the differences between categories of socioeconomic status are small. The countries with the largest differentials in chronic energy deficiency by socioeconomic status are in sub-Saharan Africa.

The proportion of mothers who are obese generally increases with socioeconomic status in the countries analyzed. However, in six countries (Kenya, Turkey, Bolivia, Colombia, Guatemala, and Peru) the proportion of obese mothers is higher in the "low" socioeconomic category than the "medium/high" category. Also, the percentage of obese mothers in Turkey and Colombia is similar across socioeconomic status categories. Egypt, the country with the highest levels of obesity, shows the greatest variation across status categories: 17 percent for "very low" versus 41 percent for "medium/high" (Figure 6.3).

⁵ Points were assigned with the following criteria: *persons per room*, two points if the ratio was 2 or less, one point if the ratio was 3-4, and zero points if the ratio was 5 or more persons per room. For possession of a *radio, TV or refrigerator*, a woman received one point, otherwise zero points. *Floor materials, water and toilet availability* added two, one, or zero points, respectively, depending on the quality of these services. For the ownership of a *car* (not for work), two points were assigned. The index can take values between zero and 13.

⁶ Here it must be remembered that 22 percent of women with higher education in Bolivia were not measured (see Table 3.2).

Table 6.1 Mean BMI among women with children under 5 years by residence

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by place of residence, Demographic and Health Surveys, 1990-1995

Country and place of residence	BMI			Number of cases
	Mean	< 18.5	30+	
Sub-Saharan Africa				
Burkina Faso				
Urban	22.27	9.6	3.3	1,107
Rural	20.75	15.7	0.6	1,905
Ghana				
Urban	23.10	10.6	7.8	472
Rural	21.16	12.9	1.7	1,129
Kenya				
Urban	23.49	4.1	6.1	367
Rural	21.75	10.8	1.9	2,687
Malawi				
Urban	22.56	7.0	4.4	555
Rural	21.38	10.0	0.6	1,553
Namibia				
Urban	24.24	8.8	13.6	717
Rural	21.59	17.0	3.9	1,370
Niger				
Urban	22.73	13.1	6.5	1,165
Rural	20.46	20.9	0.3	1,815
Senegal				
Urban	23.06	11.1	7.3	915
Rural	21.23	17.2	2.1	1,752
Tanzania				
Urban	22.51	6.1	4.0	717
Rural	21.46	10.9	1.4	3,398
Zambia				
Urban	22.56	9.3	4.6	1,314
Rural	21.06	13.3	0.5	1,656
Zimbabwe				
Urban	24.68	2.4	13.3	409
Rural	22.52	6.3	3.2	1,379
Near East/North Africa				
Egypt				
Urban	28.60	1.1	35.7	1,942
Rural	25.65	1.9	15.5	2,574
Morocco				
Urban	25.46	3.0	18.5	1,074
Rural	23.19	4.4	5.7	1,586
Turkey				
Urban	26.00	3.1	19.7	1,409
Rural	25.49	1.6	17.0	859
Latin America/Caribbean				
Bolivia				
Urban	24.58	2.8	10.2	1,187
Rural	23.85	2.1	5.2	954
Colombia				
Urban	24.51	3.8	9.2	2,134
Rural	24.36	4.0	9.1	995
Dominican Republic				
Urban	23.67	8.4	9.0	1,203
Rural	22.56	9.9	4.8	790
Guatemala				
Urban	25.25	3.1	13.1	1,209
Rural	23.56	4.3	5.3	3,327
Peru				
Urban	25.18	1.2	11.6	3,030
Rural	23.94	1.6	4.7	1,811

Table 6.2 Mean BMI among women with children under 5 years by education

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by level of education, Demographic and Health Surveys, 1990-1995

Country and mother's education	BMI			Number of cases
	Mean	< 18.5	30+	
Sub-Saharan Africa				
Burkina Faso				
None	20.78	15.3	0.5	2,430
Primary	22.10	10.4	3.0	385
Secondary/higher	23.38	10.6	7.6	197
Ghana				
None	21.17	13.6	1.6	626
Primary	21.82	12.0	3.9	878
Secondary/higher	24.48	6.2	12.4	97
Kenya				
None	21.48	17.2	3.0	532
Primary	21.88	9.0	1.9	1,823
Secondary/higher	22.64	6.6	3.6	699
Malawi				
None	21.20	12.1	0.3	862
Primary	21.68	7.2	1.2	1,107
Secondary/higher	23.94	6.8	10.0	139
Namibia				
None	22.12	19.7	5.1	353
Primary	22.03	15.3	6.2	1,008
Secondary/higher	23.56	9.3	10.6	726
Niger				
None	20.58	19.9	0.9	2,518
Primary	21.73	18.9	3.9	312
Secondary/higher	23.81	11.6	8.8	150
Senegal				
None	21.57	16.2	3.0	2,154
Primary	22.87	11.6	6.8	355
Secondary/higher	23.57	7.6	8.9	158
Tanzania				
None	21.38	12.2	1.5	1,519
Primary	21.76	8.8	1.9	2,459
Secondary/higher	24.01	4.2	9.0	137
Zambia				
None	21.19	12.5	1.3	521
Primary	21.65	11.5	2.2	1,826
Secondary/higher	22.60	10.1	4.2	620
Zimbabwe				
None	22.34	5.2	4.8	218
Primary	22.83	6.7	4.8	925
Secondary/higher	23.70	3.2	7.8	645
Near East/North Africa				
Egypt				
None	25.71	2.3	16.0	2,083
Primary	27.97	1.2	32.7	1,148
Secondary/higher	27.89	0.8	29.6	1,285
Morocco				
None	23.74	4.1	9.1	2,060
Primary	25.52	2.2	32.1	17.8
Secondary/higher	25.16	3.6	16.5	279
Turkey				
None	25.95	2.1	21.1	566
Primary	26.05	2.3	20.4	1,277
Secondary/higher	24.91	4.1	10.3	425
Latin America/Caribbean				
Bolivia				
None	23.94	1.6	1.9	308
Primary	24.59	2.0	9.5	971
Secondary/higher	23.97	3.2	8.1	862
Colombia				
None	24.34	2.8	12.7	138
Primary	24.54	3.7	9.4	1,303
Secondary/higher	24.42	4.1	8.7	1,688
Dominican Republic				
None	22.75	13.7	5.5	164
Primary	23.02	8.6	7.3	1,099
Secondary/higher	23.63	8.4	7.9	728
Guatemala				
None	23.66	3.1	4.2	1,871
Primary	24.24	4.2	9.4	2,188
Secondary/higher	25.18	4.4	13.4	477
Peru				
None	24.54	1.1	6.9	448
Primary	24.75	1.2	8.7	1,951
Secondary/higher	24.80	1.5	9.9	2,442

Figure 6.1 Percentage of women with BMI < 18.5 by place of residence, Demographic and Health Surveys 1990-1995

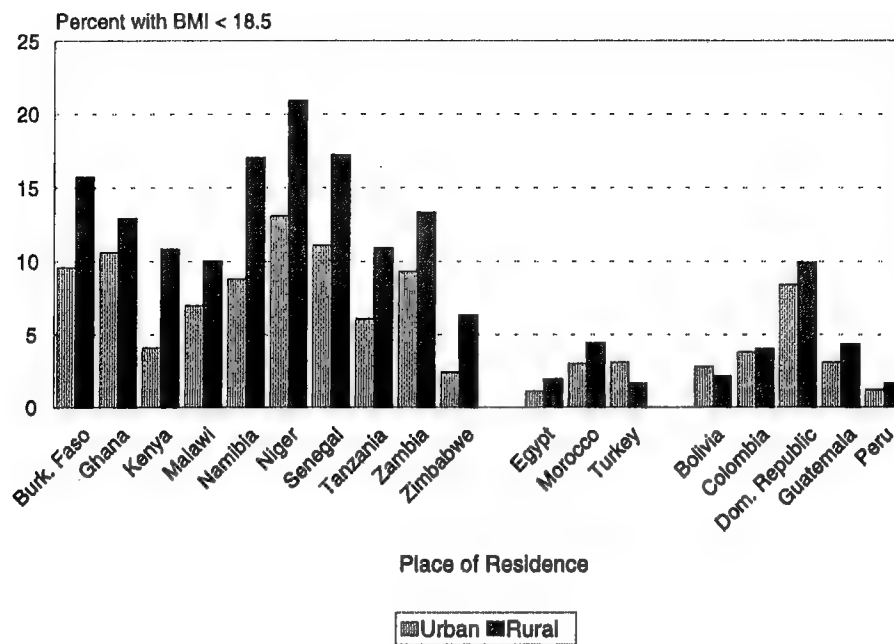


Figure 6.2 Percentage of obese women (BMI 30+) by place of residence, Demographic and Health Surveys 1990-1995

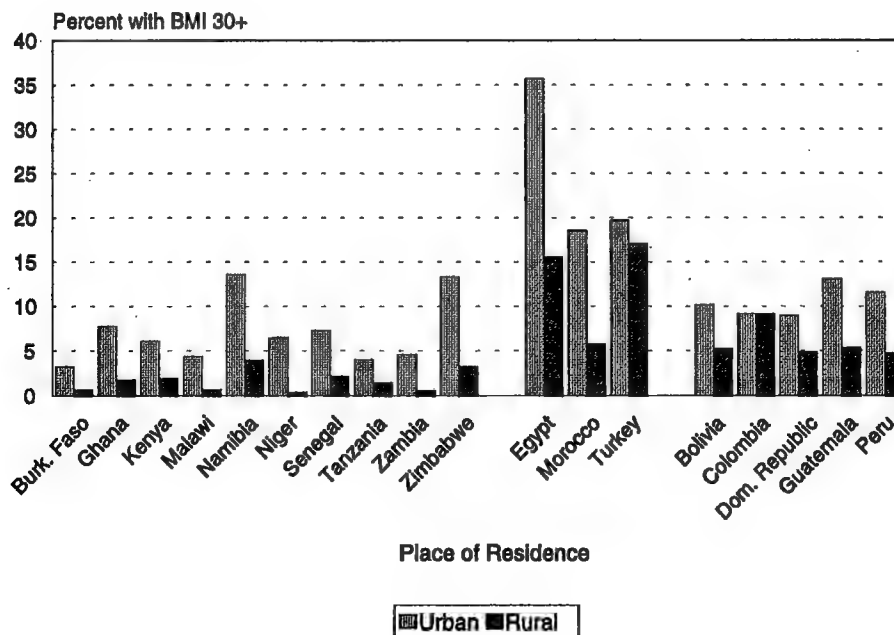


Figure 6.3 Percentage of obese women (BMI 30+) in Zimbabwe, Egypt, and Guatemala by socioeconomic status, Demographic and Health Surveys 1992-1995

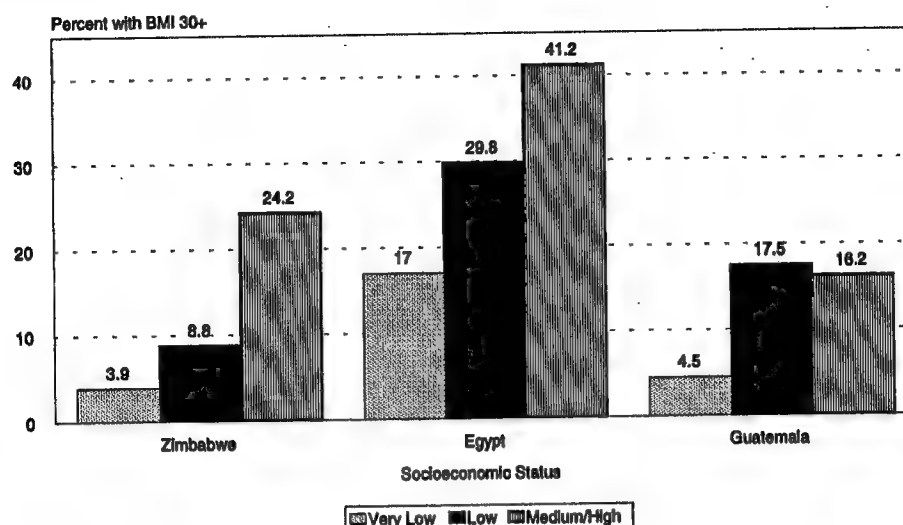


Table 6.3 Mean BMI among women with children under 5 years by socioeconomic status

Mean BMI among nonpregnant women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by socioeconomic status, Demographic and Health Surveys, 1990-1995

Country and socioeconomic status	BMI			Number of cases	Country and socioeconomic status	BMI			Number of cases
	Mean	< 18.5	30+			Mean	< 18.5	30+	
Sub-Saharan Africa					Near East/North Africa				
Burkina Faso					Egypt				
Very low	20.81	15.3	0.7	2,466	Very low	25.79	2.1	17.0	2,532
Low	22.31	10.1	2.4	390	Low	27.77	1.1	29.8	1,286
Medium/high	24.31	5.7	10.8	156	Medium/high	29.66	0.6	41.2	698
Ghana					Morocco				
Very low	21.30	13.3	2.0	1,310	Very low	22.81	4.7	4.0	1,302
Low	23.04	8.6	8.1	209	Low	24.36	4.7	13.6	472
Medium/high	25.34	4.9	15.9	82	Medium/high	25.87	2.1	19.6	886
Kenya					Turkey				
Very low	21.72	11.2	2.0	2,662	Very low	25.04	2.9	15.6	451
Low	23.28	2.5	6.1	295	Low	26.06	1.9	20.1	689
Medium/high	24.79	0.4	5.4	97	Medium/high	25.97	2.9	19.1	1,128
Malawi					Latin America/Caribbean				
Very low	21.44	9.8	0.7	1,896	Bolivia				
Low	22.33	8.7	4.4	182	Very low	24.16	2.2	7.3	1,541
Medium/high	25.42	3.2	15.3	30	Low	24.70	2.8	11.5	415
Namibia					Medium/high	24.01	3.6	5.7	185
Very low	21.53	17.2	3.4	1,413	Colombia				
Low	23.33	11.1	12.0	258	Very low	23.93	5.1	7.5	899
Medium/high	25.13	6.2	16.6	416	Low	24.45	3.9	9.9	798
Niger					Medium/high	24.79	3.1	9.8	1,432
Very low	20.55	20.2	0.7	2,560	Dominican Republic				
Low	22.80	12.5	7.1	248	Very low	22.40	10.6	4.1	885
Medium/high	25.08	8.2	17.4	172	Low	23.30	8.7	7.4	566
Senegal					Medium/high	24.09	7.6	11.0	542
Very low	21.33	16.8	2.4	1,918	Guatemala				
Low	22.89	10.7	6.5	507	Very low	23.52	4.2	4.5	3,532
Medium/high	23.93	10.3	10.3	242	Low	25.68	3.3	17.5	730
Tanzania					Medium/high	26.07	2.6	16.2	274
Very low	21.52	10.2	1.3	3,772	Peru				
Low/medium/high	23.44	6.5	8.0	347	Very low	24.31	1.3	6.2	3,035
Zambia					Low	25.45	1.9	15.9	627
Very low	21.23	12.9	1.0	2,074	Medium/high	25.33	1.1	11.9	1,179
Low	22.60	8.5	4.2	601					
Medium/high	23.61	7.5	8.5	295					
Zimbabwe									
Very low	22.62	6.0	3.9	1,469					
Low	24.20	2.6	8.8	210					
Medium/high	26.50	1.5	24.2	109					

Table 6.4 Mean BMI among women with children under 5 years by ethnic origin/religion/language

Mean BMI among nonpregnant, nonlactating women with children born in the 5-year period preceding the survey and percentage below and above the cutoff points for BMI, by ethnic origin/religion/language, Demographic and Health Surveys, 1990-1995

Country and ethnic origin/ religion/language	BMI			Number of cases
	Mean	< 18.5	30+	
Sub-Saharan Africa				
Ghana(1)				
Asa/Fan/OAka/ Ewe/Mole	21.55	13.4	2.9	1,205
Other	22.37	8.6	5.6	374
Kenya(2)				
Kal/Kam/Kik/Mer/Mij.	21.92	11.8	2.5	1,746
Other	22.12	7.1	2.6	1,308
Namibia(3)				
Eng/Afrik/Germ.	24.38	7.1	13.7	170
Ashivambo	21.98	14.4	4.0	910
Other	22.85	14.8	10.1	1,006
Niger(4)				
Hao/Kan/Peu/ Tou/OthNig.	20.46	20.8	1.0	2,115
Other	21.55	16.2	2.4	853
Senegal(5)				
Pou/Man/Bau/OthSen.	21.21	21.8	3.6	894
Other	22.18	11.7	4.0	1,772
Tanzania				
Muslim	21.78	10.6	2.2	1,930
Other	21.60	9.1	1.8	2,168
Zambia(6)				
Bem/NW/Bar/Mam.	21.72	12.8	2.5	1,748
Other	21.87	9.6	2.5	1,218
Zimbabwe				
Christian	23.58	4.7	7.8	853
Other	22.60	5.8	4.1	935
Near East/North Africa				
Egypt				
Muslim	26.94	1.5	24.2	4,267
Non-Muslim	25.96	2.8	19.8	249
Turkey				
Turkish	26.03	2.4	19.5	1,949
Non-Turkish	24.71	2.6	14.6	319
Latin America/Caribbean				
Bolivia				
Spanish	25.18	2.6	10.4	1,539
Indigenous languages	25.34	2.1	3.0	600
Guatemala				
Spanish	24.47	4.5	10.5	2,362
Indigenous languages	23.73	2.9	4.5	2,155
Peru				
Spanish	24.89	1.4	10.3	4,229
Indigenous languages	23.86	0.9	1.7	603

(1) ASA/FAN/AKA/EWE/MOLE = Asante, Fanti, Other Akan, Ewe, and Mole-Dagbani.

(2) KAL/KAM/KIK/MER/MIJ = Kalenjin, Kamba, Kikuyu, Meru/Embu, Mijikenda/Kiswahili

(3) Eng/Afrik/Germ = English, Afrikaans, and German

(4) HAO/KAN/PEU/TOU/OTHNIG = Haoussa, Kanouri, Peulh, Touareg bella, Toubou, Other Niger

(5) POUM/AN/BAU/OTHSN = Poular, Mandingue, Baub, Other Senegal

(6) BEM/NW/BAR/MAM = Bemba, Northwestern, Baroste, Mambwe.

Compared with education, socioeconomic status appears to be a better predictor of both chronic energy deficiency and obesity; although, logically, there should be a strong association between the two indicators because socioeconomic status is commonly obtained through education. This is discussed further in the last section of this report, which includes a multivariate analysis of the variables associated with maternal nutritional status.

6.4 ETHNIC ORIGIN/RELIGION/LANGUAGE

The last variable examined—ethnic origin, religion, and language—relates to the sociocultural characteristics of the population in the countries analyzed, and was obtained from responses to questions on ethnic group, religion, and language spoken at home. Since not all three questions were asked in the countries analyzed, the assumption is that any one of the three is a suitable indicator for measuring differentials in maternal nutritional status. Information is available for 13 of the 18 DHS countries analyzed. None of the questions was asked in Burkina Faso or Malawi, and of the remaining eight sub-Saharan countries, ethnic origin was asked in only six. For Tanzania, Zimbabwe, Egypt, and Turkey the analysis was based on the religion question, while in Bolivia, Guatemala, and Peru the question used was language spoken at home.

Table 6.4 presents the mean BMI and percentage of mothers with chronic energy deficiency and obesity for each category. In Latin America, indigenous mothers (those who speak an indigenous language) have a slightly lower prevalence of chronic energy deficiency and a substantially lower prevalence of obesity than mothers whose main language is Spanish. The percentage of Spanish-speaking mothers who are obese is 10 percent in all three countries, compared with 2-5 percent among mothers who speak indigenous languages. Obesity is also higher among Muslim than non-Muslim mothers in Egypt and higher among Turkish than non-Turkish mothers in Turkey. In the sub-Saharan countries, the percentage of mothers with chronic energy deficiency varies widely among ethnic groups, particularly in Ghana, Kenya, Namibia, and Senegal. In Namibia, the incidence of obesity among women of English/Afrikaans/German origin is particularly high (14 percent).

7 Relative Risks of Malnutrition

This report has presented a descriptive analysis of maternal malnutrition and its differentials by biodemographic and socioeconomic variables. Since many of these covariants are interrelated, a multivariate analysis of the determinants of maternal malnutrition was undertaken to determine the net effect on low and high BMI. Tables 7.1 and 7.2 include the odds ratios for logistic regression of determinants of chronic energy deficiency (BMI < 18.5) and obesity (BMI 30+), respectively, for each DHS country. The variables used in the descriptive analysis were placed in the logistic regression model as dichotomous variables with results significant at $p < 0.05$ and $p < 0.1$. Birth weight and child survival were not included in the model because both events occurred before assessment of the mother's chronic energy deficiency. Although these two variables can influence levels of chronic energy deficiency in mothers, they do not explain the hypothesis of intergenerational links in which mothers with chronic energy deficiency tend to have small children. Likewise, the nutritional status of the child is also excluded from the models as a covariant of the mother's chronic energy deficiency. The relationship between chronic energy deficiency in the mother and in the child appears to be one in which the mother's nutritional status can explain the nutritional status of the child but not the other way around, as hypothesized in the intergenerational links framework.

The main objective of the multivariate analysis is to examine the relationship of each variable with maternal malnutrition (chronic energy deficiency and obesity) when the effects of other variables are held constant, and then to compare the results across DHS countries and regions. Secondary objectives are to see how well the models fit the data for each country and how much variation in nutritional status indicators can be explained by the variables included in each model.

7.1 CHRONIC ENERGY DEFICIENCY

The multivariate analysis confirms most of the findings presented in the descriptive analysis (see Table 7.1), particularly in the direction of the relationship between chronic energy deficiency and its covariants. However, not all variables are significantly associated with chronic energy deficiency across DHS countries. In particular, none of the variables included has significant effects in Bolivia. The most relevant finding is the strong difference in the net risk of chronic energy deficiency by breastfeeding status and socioeconomic status.

Of the socioeconomic variables—urban-rural residence, education, and socioeconomic status—almost every country had at least one variable significantly explaining the variations in chronic energy deficiency, thus confirming the results of the

descriptive analysis. The net odds ratios of chronic energy deficiency for mothers with “very low” or “low” socioeconomic status are substantially higher than those observed for mothers with “medium/high” status. This finding not only confirms the presence of socioeconomic factors determining chronic energy deficiency but also indicates that it is among the poorer groups that chronic energy deficiency is most prevalent. In Egypt and Guatemala, none of the socioeconomic variables made the model; however, in both cases the ethnic origin/religion/language classification proved to be significant with a lower net odds ratio for “non-indigenous” and “non-Muslim” mothers. The breastfeeding status of the mother at the time of the survey shows mixed results. In Kenya, Namibia, Zimbabwe, Egypt, Morocco, and Guatemala, chronic energy deficiency net risk is greater for lactating mothers, while in Malawi, Niger, Turkey, and Peru the opposite is observed.

Urban-rural residence is an important determinant of chronic energy deficiency in Burkina Faso, Kenya, Niger, Senegal, Tanzania, Zambia, Turkey, and Peru. In the remaining countries, urban-rural residence does not explain the level of chronic energy deficiency. Mother's education is significant in only four sub-Saharan countries. In Kenya, Malawi, and Namibia mothers with no education have risks of chronic energy deficiency at least 40 percent higher than the reference group (mothers with primary education), while in Zimbabwe the relationship is significant only for the more educated mothers.

Mothers' age is also an important covariant of chronic energy deficiency, appearing significantly in 7 of the 18 DHS countries: Burkina Faso, Malawi, Namibia, Senegal, Zambia, Colombia, and Peru. Although the net odds ratios follow the direction of the descriptive results, they are only significant at younger or older age groups. In Malawi, for example, mothers age 15-19 have almost twice the risk (1.85) of chronic energy deficiency observed for mothers age 25-29 (1.00), compared with Zambia where the risk of chronic energy deficiency is around 0.90 times that observed for the reference group (mothers 25-29 years). Something similar happens at the other end of the age distribution. Namibia shows higher risk for mothers age 35-49, while Senegal and Colombia show half the risk or less of the reference group (mothers 25-29 years). Mother's age has a more important influence on the prevalence of obesity, as will be seen in the next section. It is also possible that the age effect on chronic energy deficiency is affected by the parity of the mother. With the exception of Senegal, parity 1 mothers have greater risk of chronic energy deficiency than mothers who are parity 2-3. At the same time, the net odds risk for higher parity mothers (4+) is much less than observed for the reference group (2-3 children).

Table 7.1 Net relative risk of chronic energy deficiency among nonpregnant mothers age 15-49

Net relative risk of chronic energy deficiency (BMI <18.5) among nonpregnant mothers age 15-49 by background characteristics, Demographic and Health Surveys, 1990-1995

Characteristic	Sub-Saharan Africa										Near East/North Africa				Latin America/Caribbean	
	Burkina Faso	Ghana	Kenya	Malawi	Namibia	Niger	Senegal	Tanzania	Zambia	Zimbabwe	Egypt	Morocco	Turkey	Colombia	Dominican Republic	Peru
Mother's age																
15-19	1.172			1.854*	1.106		1.719**		0.902**					1.676		2.375*
20-24	1.058			0.948	1.173		0.992		1.022					0.738		1.382
25-29	1.000			1.000	1.000		1.000		1.000					1.000		1.000
30-34	1.226			0.664	1.107		0.883		1.163					0.467**		0.896
35-49	1.425*			0.929	1.685**		0.709*		1.504*					0.215**		1.480
Residence																
Urban	1.000		1.000			1.000	1.000	1.000	1.000				1.000			1.000
Rural	1.526**		1.677*			1.554**	1.325*	1.509**	1.288*				0.383**			1.836**
Mother's education																
No education			1.647**	1.714**	1.386*					0.715						
Primary	1.000		1.000	1.000	1.000		1.000			1.000						
Secondary +	1.007		0.809	0.721						0.515**						
Socioeconomic status																
Very low	2.127*	2.895*			1.980**	2.394**			1.679*			2.631**		2.387**	1.581*	1.783
Low	1.736	1.794	2.804**		1.000	1.000			1.164			2.566**		1.279	1.339	2.603**
Medium +	1.000	1.000	1.000		1.486	1.565			1.000			1.000		1.000	1.000	1.000
Risk of previous birth interval																
Low		1.000														
High		1.40														
Parity																
1	1.058	2.119**					0.515**	1.372*	1.228							1.068
2-3	1.000	1.000					1.000	1.000	1.000							1.000
4+	0.740*	1.035					0.685**	1.334*	0.634**							0.448
Currently breastfeeding																
Yes			1.365**	0.715**	1.374**	0.830*				2.492**	1.630**	1.426*	0.433**		1.376*	0.574**
No			1.000	1.000	1.000	1.000				1.000	1.000	1.000	1.000		1.000	1.000
Ethnic/religious/linguistic group																
Yes		1.642**	1.820** ^a			1.564** ^b	1.976** ^c	1.195 ^d			2.242** ^e				1.808 ** ^f	
No		1.000	1.000			1.000	1.000	1.000			1.000				1.000	

Note: Significant at: * p < 0.1; ** p < 0.05. In Kenya the socioeconomic status classification is for low and other.

^a Kalenjin, Kamba, Kikuyu, Meru/Embu, Mijikenda/Kiswahili^b Haoussa, Kanouri, Peulh, Touareg bella, Toubou, Other Niger^c Poular, Mandingue, Baub, Other Senegal^d Bemba, Northwestern, Baroste, Mambwe.^e Muslim^f Ladino

The relative risk of chronic energy deficiency by previous birth interval is significant only in Ghana. Mothers with a first child or a child with a preceding birth interval of less than 24 months (high risk) have chronic energy deficiency risks 1.4 times those observed for mothers with a birth interval of 24 months or more (low risk). Although the results confirm the findings of the descriptive analysis, the lack of significance of this variable among sub-Saharan countries is surprising. It may be that the influence of length of previous birth interval disappears when parity is taken into the model. In Ghana and Tanzania, parity 1 mothers have higher risk of chronic energy deficiency (2.1 and 1.4 times, respectively) than other mothers. In Burkina Faso, Senegal, Zambia, and Peru, mothers in the highest parity group (4+) have lower risk of chronic energy deficiency (0.7 or less) than observed for parity 2-3 mothers (1.0). The exception is Tanzania, where parity 4+ mothers have greater risk of chronic energy deficiency (1.3).

7.2 OBESITY

The multivariate analysis results for obesity (Table 7.2) are different from those described for chronic energy deficiency. Mother's age, urban-rural residence, socioeconomic status, and parity are the main significant variables associated with obesity. The direction of the relationship of each variable with obesity remains as in the descriptive analysis. The relative risk of obesity is considerably lower for rural mothers than for urban mothers, suggesting that obesity is mainly urban phenomenon. In Egypt, where a high proportion of obesity is observed, rural mothers have about half the risk of their urban counterparts. The risk of obesity for urban mothers in Morocco and Turkey is two-thirds and three-fourths the risk for rural women, respectively.

Mother's age is significantly associated with obesity in all DHS countries except Bolivia: the older the mother, the greater the relative risk of obesity. In Turkey, for example, mothers age 15-19 have only 0.2 times the risk of obesity observed for mothers 25-29, compared with 2.2 times for those age 35-49 years. The same relationship is observed by socioeconomic status: the higher the socioeconomic status, the higher the net risk of obesity. (In Bolivia the opposite is observed.) These results are qualified by the findings on mother's education, in which less educated mothers have lower net risk of obesity. Turkey departs from this trend: the net relative risk of obesity in Turkey is lower among mothers with secondary or higher education (0.4) than those with primary education.

The inclusion of ethnic origin/religion/language in the models supports the findings by education and socioeconomic status in Ghana, Namibia, Niger, Egypt, Turkey, Bolivia, and Peru. In Bolivia, for example, indigenous mothers have a lower net risk of obesity (0.4) independent of the net relative risk observed by education or socioeconomic status. Combining the net relative risk for ethnic origin/religion/language and socioeconomic status obtains net relative risks of obesity that are always lower for indigenous mothers.

Socio-economic Status	Ethnicity	
	Indigenous	Nonindigenous
Low	$1.915 \times 0.404 = 0.774$	$1.915 \times 1.000 = 1.915$
Medium/High	$1.000 \times 0.404 = 0.404$	$1.000 \times 1.000 = 1.000$

The biodemographic covariants of obesity appear to have greater importance in the Near East/North African and Latin American countries. Parity, breastfeeding status, and previous birth interval tend to enter the model of obesity risks in these countries more often than in sub-Saharan Africa. As expected, parity of the mother is positively associated with the net risk of obesity. In Peru, for example, first-child mothers and those with the highest parity (4+) have 0.7 and 1.9 times the net relative risk of obesity observed for mothers with 2-3 children (1.0). Lactating mothers are less likely to be obese in Namibia, Egypt, Morocco, Turkey, the Dominican Republic, Guatemala, and Peru.

Table 7.2 Net relative risk of obesity among nonpregnant mothers age 15-49

Net relative risk of obesity (BMI 30+) among nonpregnant mothers age 15-49 by background characteristics, Demographic and Health Surveys, 1990-1995

Characteristic	Sub-Saharan Africa							Near East/North Africa				Latin America/Caribbean						
	Burkina Faso	Ghana	Kenya	Malawi	Namibia	Niger	Senegal	Tanzania	Zambia	Zimbabwe	Egypt	Morocco	Turkey	Bolivia	Colombia	Dominican Republic	Guatemala	Peru
Mother's age																		
15-19	1.993*	a	1.040	13.438*	0.083**	a	a	a	0.581	1.184	0.455**	1.216	0.239**	0.344**	0.393*	0.236**	0.294**	
20-24	0.545	0.803	0.409*	5.348	0.332**	0.451*	1.278	0.393*	0.923	0.349**	0.450**	0.510**	0.667*	0.677*	0.480**	0.615**	0.600**	
25-29	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
30-34	2.220*	1.521	1.751	19.376**	1.532	1.110	1.844*	2.467*	2.338*	1.592	1.200*	0.952	1.230	1.711**	0.864	1.014	1.091	
35-49	2.589*	2.416**	2.902**	9.739**	2.087**	1.862*	3.211**	6.092**	3.569**	1.392	1.527**	1.473**	2.225**	1.751**	0.972	1.279	1.639**	
Residence																		
Urban	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Rural	0.437**	0.385**	0.385**	0.356**	0.557**	0.086**	0.424**	0.418**	0.145**	0.308*	0.481**	0.688**	0.734**	0.571**	0.584**	0.568**		
Mother's education																		
No education	0.330**	0.471*		0.245**							0.550**		0.900	0.265**	0.468*	0.585**		
Primary	1.000	1.000		1.000							1.000		1.000	1.000	1.000	1.000		
Secondary +	1.670	0.972		4.402**							0.830**		0.385**	0.861	0.759	0.753		
Socioeconomic status																		
Very low	0.235**	0.248**			0.326**	0.201**	0.353**	0.225**	0.242**	0.388**	0.483**	0.238**	0.696**	1.497	0.573**	0.445**	0.358**	0.518**
Low	0.397*	0.649			0.979	0.481**	0.622	a	0.484**	0.558*	0.798*	0.735*	0.966	1.915*	0.977	0.637**	0.915	1.156
Medium +	1.000	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Risk of previous interval																		
Low							0.636**	0.589**			1.309**				1.373*	1.446*	1.326**	
High							1.000	1.000			1.000				1.000	1.000	1.000	
Parity																		
1	0.092**							0.508	0.530		0.712**	0.722	0.679**	0.511**	0.611**	0.618*	0.480**	0.663**
2-3	1.000							1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
4+	0.933							0.439**	2.460*		1.307**	1.528**	1.207	1.568*	1.345*	1.234	1.154	1.911**
Currently breastfeeding																		
Yes							0.622**				0.562**	0.540**	0.769*			0.455**	0.556**	0.769**
No							1.000				1.000	1.000	1.000			1.000	1.000	1.000
Ethnic/religious/linguistic group																		
Yes	0.542**				0.455 ^b	0.501** ^c					0.650** ^d		0.663** ^e	0.404** ^f				0.234** ^f
No	1.000				1.000	1.000					1.000		1.000	1.000				1.000

Significant at: * p<0.10; ** p<0.05

^a zero cases category^b English, Afrikaans, German^c Haoussa, Kanouri, Peulh, Touareg bella, Toubou, Other Niger^d Muslim^e Non-Turkish^f Quechua, Aymara, Other indigenous language

8 Summary and Conclusions

Maternal nutritional status is a reflection not only of women's health but also of the level of the society's level of development. Chronic energy deficiency results from exposure to a number of risk factors including infectious illnesses, food scarcity, inadequate food intake, high parity, short birth intervals, and lack of access to appropriate reproductive health services and education. In developing countries, maternal chronic energy deficiency is both a biological and a socioeconomic problem. On the one hand, low birth weight children, especially children of mothers with chronic energy deficiency, tend to grow into small-sized adults who enter reproductive life at an early age, have small birth intervals, and ultimately achieve high parities; the result is a new generation of low birth weight, children with chronic energy deficiency. On the other hand, developing countries may lack the necessary resources, programs, and infrastructure to deal with problems of chronic energy deficiency. Social programs relating to health, education, and housing may not be a first priority in countries facing problems such as internal warfare and debt. As a result, maternal chronic energy deficiency is little recognized and insufficiently documented in developing countries.

Nutritional status, based on maternal height and weight, is an important outcome measure of the DHS program. Typically, maternal height is a good indicator of socioeconomic status and is useful for identifying women at nutritional risk; additionally, maternal weight is closely associated with birth weight and infant mortality. Since nationally representative samples are used, DHS data permit comparison of maternal nutritional status within and across countries. This report presents descriptive information on maternal anthropometry related to the nutritional status of women with children born in the five years before the survey. It also analyzes the differentials in levels of maternal nutritional status by selected demographic, socioeconomic, and health-related characteristics. Two indicators of malnutrition obtained from the BMI distribution are used in this report: chronic energy deficiency (the percentage of women with BMI < 18.5), and obesity (the percentage of women with BMI 30+). The relative risk of malnutrition is also examined using multivariate analysis to determine the effects of a particular variable when other variables are held constant.

The level of maternal malnutrition (chronic energy deficiency and obesity) varies between countries and between regions, however, three general patterns have been identified:

- *The sub-Saharan pattern* shows high percentages of mothers with chronic energy deficiency and low percentages of mothers who are obese. Women tend to be tall and thin, with 10 percent or more of the mothers classified as having chronic energy deficiency. In Niger, one-fifth of the women with children born during the five years preceding the survey had chronic energy deficiency. These women would be at high risk for unfavorable pregnancy outcome if they were to become pregnant immediately.

- *The Near East/North African pattern* has low percentages of mothers with chronic energy deficiency and high percentages of mothers who are obese. In Egypt, Morocco, and Turkey, more than one-third of the women are overweight; in Egypt and Turkey, 18 percent or more are classified as obese (BMI 30+).

- *The Latin American pattern* has relatively low percentages of mothers with chronic energy deficiency and moderate percentages of mothers who are obese. In Bolivia, Guatemala, and Peru, the low prevalence of chronic energy deficiency occurs together with a high proportion of stunting.

The nutritional status of mothers varies by age due to weight gain during the reproductive years. Younger mothers have greater prevalence of chronic energy deficiency, particularly in Namibia, Niger, and Senegal. By age 30, one-tenth of the mothers in Egypt and Turkey are obese, compared with 3 percent or less in the other countries. As with age, BMI increases with mother's parity, except for countries where parity 6 or more is associated with lower BMI and, therefore, higher percentages of chronic energy deficiency. Part of the increase observed in the mean BMIs by parity may be associated with obesity. Generally, obesity increases with parity, but for some countries it decreases after parity 4-5. These results indicate the existence of maternal depletion over the long term, which tends to occur in countries with high levels of fertility. Almost all countries show a consistent pattern linking malnutrition with birth intervals: high percentages of chronic energy deficiency among mothers of first births or mothers with birth intervals of less than 24 months, and high percentages of obesity among mothers with birth intervals of 24 months or more.

The postpartum period, during which breastfeeding can affect the weight of the mother, has an impact on the level of chronic energy deficiency during the first year and a half following the birth of a child. Some variations are observed across countries, and are probably related to the length of the lactation period. In sub-Saharan Africa, where the average duration of breastfeeding is around 20 months, the percentage of mothers with chronic energy deficiency increases with the duration of the postpartum period, and stabilizes around 10 percent after three years (22 percent in Niger). Women tend to lose weight over the course of lactation, thus affecting their BMI. Although the mean BMI is lower for lactating mothers, in 7 of the 18 countries analyzed, the prevalence of chronic energy deficiency is higher among "nonlactating" women. As expected, obesity is more prevalent among nonlactating women.

BMIs are lower among mothers of low birth weight children. The prevalence of chronic energy deficiency by birth weight of the last child is highest in sub-Saharan Africa. In Burkina Faso, Malawi, Namibia, and Niger, the prevalence of chronic energy deficiency among mothers of low birth weight

children is substantially higher than among mothers of children with average birth weights. Likewise, mothers of stunted children in all sub-Saharan countries show higher prevalence of chronic energy deficiency, particularly mothers of younger children (< 24 months). In Namibia, 23 percent of the mothers of stunted children have chronic energy deficiency, compared with 13 percent of mothers whose children have normal height-for-age. The descriptive analysis of maternal chronic energy deficiency and child survival produced mixed results with no specific pattern across countries or regions.

There are marked differences in the levels of malnutrition between urban and rural areas. Chronic energy deficiency is more common in rural areas in all DHS countries (except Bolivia and Turkey), while obesity is predominantly an urban manifestation. Chronic energy deficiency is particularly high in rural areas of Burkina Faso, Namibia, Niger, and Senegal, where more than 15 percent of mothers have BMI < 18.5. As expected, chronic energy deficiency decreases as mother's level of education increases, especially in sub-Saharan Africa. In Burkina Faso, Kenya, Namibia, Niger, and Senegal, the prevalence of chronic energy deficiency is more than 15 percent among mothers with no education. The relationship between obesity and education varies: Turkey and Colombia show high proportions of obese mothers among those with no education, while Egypt and Guatemala show high levels among mothers with secondary or higher education.

Compared with education, level of socioeconomic status is a better predictor of both chronic energy deficiency and obesity. The higher the level of socioeconomic status of the mother, the lower the prevalence of malnutrition, particularly in sub-Saharan Africa. Ethnic origin, religion, and language also show differentials in maternal. In Latin America, indigenous mothers tend to have higher levels of chronic energy deficiency and lower levels of obesity compared with mothers whose main language is Spanish. Obesity is higher among Muslim Egyptian mothers and Turkish mothers than among non-Muslim Egyptian mothers and non-Turkish mothers.

The multivariate analysis confirms most of the findings presented in the descriptive analysis, particularly in the direction of the relationship between chronic energy deficiency and its covariants. In Kenya, Zimbabwe, Egypt, Morocco, and Guatemala, chronic energy deficiency net risk is greater for lactating than nonlactating women, suggesting reduced effectiveness of lactation and poor infant growth. However, in Malawi, Niger, Peru, and Turkey the opposite is observed (in contrast to the pattern seen in the descriptive analysis). This last finding may be an indication that lactating mothers are at less risk of chronic energy deficiency if the risks observed for other variables are eliminated. At least one of the socioeconomic variables (i.e., place of residence, education, socioeconomic status, ethnic group) entered the model, confirming the importance of this variable in explaining maternal chronic energy deficiency.

Regarding obesity, the following variables have significant effects over and above other variables in the model: age,

place of residence, socioeconomic status, and the parity of the mother. The relative risk of obesity for rural mothers is considerably lower than for urban counterparts, confirming the results presented in the descriptive analysis. In Egypt, Morocco, and Turkey, the risk of obesity for rural mothers is half, two-thirds, and three-fourths the risk for their urban counterparts, respectively. In general, the higher the level of socioeconomic status or education, the higher the relative risk of obesity. These findings are substantiated in Ghana, Namibia, Niger, Egypt, Turkey, Bolivia, and Peru, with the inclusion of ethnic origin/religion/language.

The risk of obesity tends to be determined primarily by socioeconomic variables and seems to be a greater problem for Near East and North African countries. The relative risk of chronic energy deficiency is also determined largely by socioeconomic variables, especially in sub-Saharan Africa. However, fertility variables and child health variables appear to operate as intermediate variables regarding maternal malnutrition.

Improvements in women's nutritional status will only be seen when mothers and their children are no longer exposed to the risk factors leading to malnutrition. Actions that would reduce these risk factors are emphasized in the Program of Action of the 1994 International Conference on Population and Development and include the following:

- Maximize the cost-effectiveness of health programs to reduce morbidity and mortality, and ensure access to basic health care services for all people. Special attention should be given to the living conditions of the poor and disadvantaged in urban and rural areas.
- Expand the provision of maternal health services in the context of primary health care including: education on safe motherhood, prenatal care, maternal nutrition programs, adequate delivery assistance, referral services for pregnancy, childbirth and abortion complications, postnatal care, and family planning.
- Design and implement programs addressing the nutritional needs of women of child-bearing age, especially those who are pregnant or breastfeeding. These programs should also give particular attention to the prevention and management of nutritional anemia and iodine-deficiency disorders.
- Improve the nutrition and health status of young women through education and training as part of maternal health and safe motherhood programs. Adolescents should receive information, education, and counseling to delay family formation, premature sexual activity, and first pregnancy.
- Ensure food security for families with children and prevent micronutrient deficiencies.

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Appendix

Summary of DHS-I, DHS-II, and DHS-III Surveys, 1985-1997

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA						
DHS-I						
Botswana	Aug-Dec 1988	Central Statistics Office	AW 15-49	4,368		AIDS, PC, adolescent fertility
Burundi	Apr-Jul 1987	Département de la Population, Ministère de l'Intérieur	AW 15-49	3,970	542 Husbands	CA, SAI, adult mortality
Ghana	Feb-May 1988	Ghana Statistical Service	AW 15-49	4,488	943 Husbands	CA, SM, WE
Kenya	Dec-May 1988/89	National Council for Population and Development	AW 15-49	7,150	1,133 Husbands	
Liberia	Feb-Jul 1986	Bureau of Statistics, Ministry of Planning and Economic Affairs	AW 15-49	5,239		TBH, employment status
Mali	Mar-Aug 1987	Institut du Sahel, USED/CERPOD	AW 15-49	3,200	970 Men 20-55	CA, VC, childhood physical handicaps
Ondo State, Nigeria	Sep-Jan 1986/87	Ministry of Health, Ondo State	AW 15-49	4,213		CA, TBH
Senegal	Apr-Jul 1986	Direction de la Statistique, Ministère de l'Economie et des Finances	AW 15-49	4,415		CA, CD
Sudan	Nov-May 1989/90	Department of Statistics, Ministry of Economic and National Planning	EMW 15-49	5,860		FC, M, MM
Togo	Jun-Nov 1988	Unité de Recherche Démographique, Université du Bénin	AW 15-49	3,360		CA, SAI, marriage history
Uganda	Sep-Feb 1988/89	Ministry of Health	AW 15-49	4,730		CA, SAI
Zimbabwe	Sep-Jan 1988/89	Central Statistical Office	AW 15-49	4,201		AIDS, CA, PC, SAI, WE
DHS-II						
Burkina Faso	Dec-Mar 1992/93	Institut National de la Statistique et de la Démographie	AW 15-49	6,354	1,845 Men 18+	AIDS, CA, MA, SAI
Cameroon	Apr-Sep 1991	Direction Nationale du Deuxième Recensement Général de la Population et de l'Habitat	AW 15-49	3,871	814 Husbands	CA, CD, SAI
Madagascar	May-Nov 1992	Centre National de Recherches sur l'Environnement	AW 15-49	6,260		CA, MM, SAI
Malawi	Sep-Nov 1992	National Statistical Office	AW 15-49	4,850	1,151 Men 20-54	AIDS, CA, MA, MM, SAI
Namibia	Jul-Nov 1992	Ministry of Health and Social Services, Central Statistical Office	AW 15-49	5,421		CA, CD, MA, MM
Niger	Mar-Jun 1992	Direction de la Statistique et des Comptes Nationaux	AW 15-49	6,503	1,570 Husbands	CA, MA, MM, SAI
Nigeria	Apr-Oct 1990	Federal Office of Statistics	AW 15-49	8,781		CA, SAI
Rwanda	Jun-Oct 1992	Office National de la Population	AW 15-49	6,551	598 Husbands	CA
Senegal	Nov-Aug 1992/93	Direction de la Prévision et de la Statistique	AW 15-49	6,310	1,436 Men 20+	AIDS, CA, MA, MM, SAI
Tanzania	Oct-Mar 1991/92	Bureau of Statistics, Planning Commission	AW 15-49	9,238	2,114 Men 15-60	AIDS, CA, MA, SAI
Zambia	Jan-May 1992	University of Zambia	AW 15-49	7,060		AIDS, CA, MA

DHS-III						
Benin	Jun-Aug 1996	Institut National de la Statistique	AW 15-49	5,491	1,535 Men 20-64	AIDS, CA, MA, MM, SAI
Central African Republic	Sep-Mar 1994/95	Direction des Statistiques Démographiques et Sociales	AW 15-49	5,884	1,729 Men 15-59	AIDS, CA, CD, MA, MM, SAI
Comoros	Mar-May 1996	Centre National de Documentation et de la Recherche Scientifique	AW 15-49	3,050	795 Men 15-64	CA, MA
Côte d'Ivoire	Jun-Nov 1994	Institut National de la Statistique	AW 15-49	8,099	2,552 Men 12-49	CA, MA, SAI
Eritrea	Sep-Jan 1995/96	National Statistics Office	AW 15-49	5,054	1,114 Men 15-59	AIDS, CA, MA, MM, SAI
Ghana	Sep-Dec 1993	Ghana Statistical Service	AW 15-49	4,562	1,302 Men 15-59	CA, MA
Kenya	Feb-Aug 1993	National Council for Population and Development	AW 15-49	7,540	2,336 Men 15-54	AIDS, CA, MA, SAI
Malawi (KAP)	Jun-Oct 1996	National Statistical Office	AW 15-49	2,683	2,658 Men 15-54	AIDS
Mali	Nov-Apr 1995/96	CPS/MSSPA et DNSI	AW 15-49	9,704	2,474 Men 15-59	AIDS, CA, MA, MM, SAI
Tanzania (KAP)	Jul-Sep 1994	Bureau of Statistics, Planning Commission	AW 15-49	4,225	2,097 Men 15-59	AIDS, PC
Tanzania (In-depth)	Jun-Oct 1995	Bureau of Statistics, Planning Commission	AW 15-49	2,130		Adult and childhood mortality estimation
Tanzania	Jul-Nov 1996	Bureau of Statistics, Planning Commission	AW 15-49	8,120	2,256 Men 15-59	AIDS, CA, MA, MM
Uganda	Mar-Aug 1995	Statistics Department, Ministry of Finance and Economic Planning	AW 15-49	7,070	1,996 Men 15-59	AIDS, CA, MA, MM, SAI
Uganda (In-depth)	Oct-Jan 1995/96	Institute of Statistics and Applied Economics, Makerere University	AW 20-44	1,750	1,356 Partners	Negotiating reproductive outcomes
Zambia	Jul-Jan 1996/97	Central Statistics Office	AW 15-49	8,021	1,849 Men 15-59	AIDS, CA, MA, MM
Zimbabwe	Jul-Nov 1994	Central Statistical Office	AW 15-49	6,128	2,141 Men 15-54	AIDS, CA, MA, MM, PC, SAI
NEAR EAST/NORTH AFRICA						
DHS-I						
Egypt	Oct-Jan 1988/89	National Population Council	EMW 15-49	8,911		CA, CD, MM, PC, SAI, WE, WS
Morocco	May-Jul 1987	Ministère de la Santé Publique	EMW 15-49	5,982		CA, CD, S
Tunisia	Jun-Oct 1988	Office National de la Famille et de la Population	EMW 15-49	4,184		CA, S, SAI
DHS-II						
Egypt	Nov-Dec 1992	National Population Council	EMW 15-49	9,864	2,466 Husbands	CA, MA, PC, SM
Jordan	Oct-Dec 1990	Department of Statistics, Ministry of Health	EMW 15-49	6,461		CA, SAI
Morocco	Jan-Apr 1992	Ministère de la Santé Publique	AW 15-49	9,256	1,336 Men 20-70	CA, MA, MM, SAI
Yemen	Nov-Jan 1991/92	Central Statistical Organization	EMW 15-49	5,687		CA, CD, SAI
DHS-III						
Egypt	Nov-Jan 1995/96	National Population Council	EMW 15-49	14,779		CA, FC, MA, WS
Morocco (Panel)	Apr-May 1995	Ministère de la Santé Publique	AW 15-49	4,753		

ASIA

DHS-I

Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,884		PC, SM
Nepal (In-depth)	Feb-Apr 1987	New Era	CMW 15-49	1,623		KAP-gap survey
Sri Lanka	Jan-Mar 1987	Department of Census and Statistics, Ministry of Plan Implementation	EMW 15-49	5,865		CA, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies Chulalongkorn University	EMW 15-49	6,775		CA, S, SAI

DHS-II

Indonesia	May-Jul 1991	Central Bureau of Statistics, NFPCB/MOH	EMW 15-49	22,909		PC, SM
Pakistan	Dec-May 1990/91	National Institute of Population Studies	EMW 15-49	6,611	1,354 Husbands	CA

DHS-III

Bangladesh	Nov-Mar 1993/94	Mitra & Associates/NIPORT	EMW 10-49	9,640	3,284 Husbands	PC, SAI, SM
Bangladesh	Nov-Mar 1996/97	Mitra & Associates/NIPORT	EMW 10-49	9,127	3,346 EMM	CA, MA, SM
Indonesia	Jul-Nov 1994	Central Bureau of Statistics/ NFPCB/MOH	EMW 15-49	28,168		MM, PC, SAI, SM
Kazakstan	May-Aug 1995	Institute of Nutrition, National Academy of Sciences	AW 15-49	3,771		CA, MA
Nepal	Jan-Jun 1996	Ministry of Health/New ERA	EMW 15-49	8,429		CA, MA, MM
Philippines	Apr-Jun 1993	National Statistics Office	AW 15-49	15,029		MM, SAI
Turkey	Aug-Oct 1993	General Directorate of MCH/FP Ministry of Health	EMW <50	6,519		CA, MA
Uzbekistan	Jun-Oct 1996	Research Institute of Obstetrics and Gynecology	AW 15-49	4,415		CA, MA

LATIN AMERICA/CARIBBEAN

DHS-I

Bolivia	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		CA, CD, MM, PC, S, WE
Bolivia (In-depth)	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-44	5,892		CA, S, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	AW 15-49	5,329		CA, PC, S, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	7,649		CA, NFP, S, SAI, family planning communication
Dominican Republic (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	3,885		S, SAI
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	AW 15-49	4,713		CD, SAI, employment
El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	AW 15-49	5,207		CA, S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	AW 15-44	5,160		CA, S, SAI
Mexico	Feb-May 1987	Dirección General de Planificación	AW 15-49	9,310		NFP, S, employment

Peru	Sep-Dec 1986	Familiar, Secretaría de Salud Instituto Nacional de Estadística	AW 15-49	4,999		NFP, employment, cost of family planning
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	2,534		
Trinidad and Tobago	May-Aug 1987	Family Planning Association of Trinidad and Tobago	AW 15-49	3,806		CA, NFP, breastfeeding
DHS-II						
Brazil (NE)	Sep-Dec 1991	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	6,222	1,266 Husbands	AIDS, PC
Colombia	May-Aug 1990	PROFAMILIA	AW 15-49	8,644		AIDS
Dominican Republic	Jul-Nov 1991	Instituto de Estudios de Población y Desarrollo (PROFAMILIA), Oficina Nacional de Planificación	AW 15-49	7,320		CA, MA, S, SAI
Paraguay	May-Aug 1990	Centro Paraguayo de Estudios de Población	AW 15-49	5,827		CA, SAI
Peru	Oct-Mar 1991/92	Instituto Nacional de Estadística e Informática	AW 15-49	15,882		CA, MA, MM, SAI
DHS-III						
Bolivia	Nov-May 1993/94	Instituto Nacional de Estadística	AW 15-49	8,603 ^b		AIDS, CA, CD, MA, MM, S, SAI
Brazil	Mar-Jun 1996	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	12,612	2,949 Men 15-59	AIDS, CA, MA, MM, PC, S
Colombia	Mar-Jun 1995	PROFAMILIA	AW 15-49	11,140		AIDS, CA, MA, PC
Dominican Republic	Aug-Dec 1996	CESDEM/PROFAMILIA	AW 15-49	8,422	2,279 Men 15-64	CA, MA
Guatemala	Jun-Dec 1995	Instituto Nacional de Estadística	AW 15-49	12,403		AIDS, CA, MA, MM, S
Haiti	Jul-Jan 1994/95	Institut Haitien de l'Enfance	AW 15-49	5,356	1,610 Men 15-59	AIDS, CA, CD, MA, SAI
Peru	Aug-Nov 1996	Instituto Nacional de Estadística e Informática	AW 15-49	28,951	2,487 Men 15-59	CA, MA, MM

^a No health or birth history section in questionnaire.

^b Household questionnaire was administered in 26,144 households.

AIDS acquired immune deficiency syndrome
 AW all women
 CA child anthropometry
 CD causes of death (verbal reports of symptoms)
 CMW currently married women
 EMW ever-married women

FC female circumcision
 M migration
 MA maternal anthropometry
 MM maternal mortality
 NFP natural family planning
 PC pill compliance

S sterilization
 SAI service availability information
 SM social marketing
 TBH truncated birth history
 VC value of children
 WE women's employment
 WS women's status

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